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The third Wednesday of each month, 8:15 p.m. at the Natural History Society of Maryland (except May—August, third Saturday of each month, 8:00 a.m.). The Department of Herpetology meets informally on all other Wednesday evenings at the NHSM at 8:00 p.m.

ALBINISM AND DISTRIBUTIONAL RECORDS FOR *LAMPROPELTIS TRIANGULUM* (REPTILIA:SERPENTES) IN PANHANDLE TEXAS

Kathleen B. Blair, Hobart M. Smith and David Chiszar

An albino *L. t. gentilis* is recorded from Carson Co., Texas, the first of that subspecies as an albino and from that county. First county records are also given for the same subspecies in Potter and Randall counties. The previous record of *L. t. celaenops* for Dallam Co. is corrected to *L. t. gentilis*, whose range is revised to included all of the Texas Panhandle except the southwestern corner.

Although numerous albinos have been recorded for *Lampropeltis triangulum* (Lacépède), most represent the nominotypical subspecies (Hensley, 1959; Gilboa and Dowling, 1974; Dyrkacz, 1981); so far as we are aware, none belong to *L. t. gentilis* (Baird and Girard). A pink-eyed, leucistic (Dyrkacz, 1981:3) albino (West Texas A & M Univ. 2802) of that subspecies is therefore of interest. It was found 4 September, 1965, by Mary Burcham, in Carson Co., Texas, 3 mi E and 1 mi N White Deer. The snake is a male, 556 mm total length, tail 87 mm; dorsal scale rows 21-19; ventrals 187; caudals 48, tail complete; 2-2 postoculars; 1-1 preoculars, fused on right side with supraocular; 7-7 supralabials, 3rd and 4th contacting eye; 9-9 infralabials, 1-4 contacting anterior chinshields, 4-5 posterior chinshields; 2-2-3 temporals.

The specimen is readily identifiable as a *Lampropeltis*, having smooth scales, an undivided anal and a maximum of 21 dorsal scale rows. However, three species of that genus occur in the Texas Panhandle: *L. calligaster* (Harlan), *L. getula* (Linnaeus), and *L. triangulum*, all most readily distinguished by color and pattern, neither of which can aid in identification of this albino. The first species, however, has a maximum dorsal scale row count of no less than 23 (Blanchard, 1921), and *L. getula* has a minimum of 197 ventrals (Blaney, 1977), whereas the two subspecies of *L. triangulum* occurring in the Texas Panhandle (Dixon, 1987; Williams, 1988) have a maximum of 21 or 23 dorsal scale tows, and ventrals 171-190 in males. Accordingly, identification of the albino as L. *triangulum* is assured definitively.

However, the two subspecies of *L. triangulum* occurring in the Texas Panhandle (Dixon, 1987; Chiszar and Smith, 1992) can be distinguished only by pattern, hence subspecific allocation of the albino must depend on geographical provenience. Unfortunately, the locality represented by the snake lies close to the contact zone (Fig. 1) of *L. t. celaenops* Stejneger and *L. t. gentilis*, although closer to the range of the latter than of the former, according to the maps of Dixon (1987), Williams (1988) and Conant and Collins (1991), and the record for *L. t. celaenops* (Dallam Co.) in Chiszar and Smith (1992).

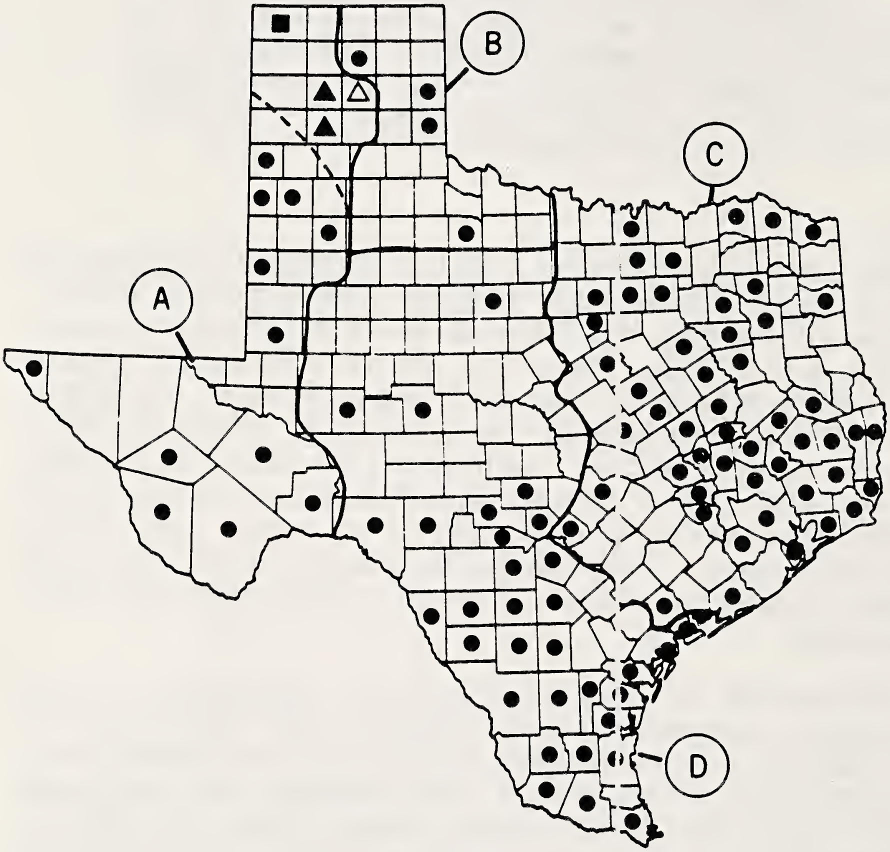

Fig. 1. Distribution of the subspecies of *Lampropeltis triangulum* in Texas, adapted from Dixon (1987: 254). A, *L. t. celaenops*; B, *L. t. gentilis*; C, *L. t. amaura* Cope; D, *L. t. annulata* Kennicott. Dots, counties for which records appeared in Dixon (1987); hollow triangle, present record of an albino *L. t. gentilis*, Carson Co.; solid triangles, present records of the latter subspecies for Potter and Randall counties; square, previous record of *L. t. gentilis* (erroneously reported as *L. t. celaenops*) for Dallam Co. Dashed line indicates a suggested new boundary line between the ranges of *L. t. celaenops* and *L. t. gentilis*, replacing the corresponding part of the line in Dixon (1987).

No other record for *L. triangulum* is available for Carson Co. (Dixon, 1987), which might serve as a clue to subspecific identity of the population represented by the albino. However, material from Hutchinson Co., bordering Carson Co. to the north, was recorded by Dixon (1987) as *L. t. gentilis*, and we here report two specimens of the same subspecies from nearby Potter Co. (WTAMU 5274, 23 mi N Amarillo; WTAMU 6458, Amarillo) and another from Randall Co. (WTAMU 2496, Hy 1714 1.7 mi E jct Hy 1705). All of those specimens have most or all (except first) of the red rings interrupted by black ventrally, and some of the red rings are crossed by black middorsally also. Neither condition is characteristic of *L. t. celaenops*, and they constitute the primary distinction between the two subspecies. One (no. 6458) has only 18 red rings on body, fewer than the range for *L. t. gentilis* (20-32) given by Williams (1988: 80), although within the range given for *L. t. celaenops* (17-25). The other two specimens have 23 and 22 red rings on body respectively. Therefore, since Carson Co. is surrounded by counties represented by L. *t. gentilis*, not *L. t. celaenops*, we conclude with confidence that the albino from there also represents that subspecies.

Apparently all but the southwestern corner of the panhandle of Texas is occupied by *L. t. gentilis*, much as mapped by Williams (1988: 11), contrary to the projected range in Dixon (1987: 254) for *L. t. celaenops*. The only actual record for the latter subspecies in the Texas Panhandle is that of Chiszar and Smith (1992), although both Dixon (1987) and Williams (1988) record it from counties just south of there. The Dallam Co. specimen reported as *L. t. celaenops* was so identified, in the absence of comparative material from nearby, in deference to the projected range of the subspecies in Dixon (1987: 254) and in conformance with the key in that work. That key erroneously singles out *L. t. gentilis* as having the red rings on body complete, whereas, according to Williams (1988: 80) they "are normally interrupted by black pigment, midventrally." All 26 of the red rings on body of the Dallam Co. specimen (UCM 56597) are interrupted by black pigment midventrally, except for the incomplete anal ring. In addition, 22 are interrupted by black middorsally, as is characteristic of *L. t. gentilis*, but not of *L. t. celaenops*. Hence the Dallam Co. specimen is properly assigned to *L. t. gentilis*. In its conjunction with the material now available from Potter and Randall counties, the northeastern range limit of L. *t. celaenops* in northwestern Texas needs to be shifted farther southwest than formerly projected, more or less as indicated in Fig. 1.

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VARIATION IN THE LINED SNAKE (*TROPIDOCLONION LINEATUM*) IN NORTHERN TEXAS

Hobart M. Smith and David Chiszar

Variation in 57 specimens of *Tropidoclonion lineatum* from the Panhandle of Texas does not support their allocation to *T. l. mertensi*; that material conforms in critical respects with *T. l. lineatum*, from which *T. l. mertensi* does not appear to be sufficiently differentiated to recognize as distinct. The southwestern range limits of *T. l. lineatum* therefore extend into northwestern Texas as well as eastern Colorado and northeastern and central New Mexico. Nothing in the variation here reported alters the status of the three valid subspecies of *T. lineatum*, all of which occur in Texas. An albino, the second on record, is from Jones Co., Texas, and represents an intergrade between *T. l. annectens* and *T. l. texanum*.

To the three subspecies of *Tropidoclonion lineatum* (Hallowell) initially distinguished by Ramsey (1953) (*T. l. lineatum*, *T. l. annectens* Ramsey, *T. l. texanum* Ramsey), *T. l. mertensi* was added by Smith (1965) on the basis of 39 specimens from northeastern New Mexico. All four subspecies were recognized in the first and second editions of the lists of North American amphibians and reptiles (Collins et al., 1978, 1982), and the eastern subspecies were recognized in the first and second editions of Conant's (1958, 1975) field guides, but none were recognized in the third editions of these works (Collins, 1990; Conant and Collins, 1991). *T. l. mertensi* was recognized in neither edition of Stebbins' guide (1966, 1985), but implicitly was synonymized with *T. l. lineatum*, which was recognized. Dixon (1987) recognized and mapped the distribution of *T. l. mertensi*, *T. l. texanum* and *T. l. annectens* in Texas, without, however, admission of areas of intergradation between any of them, contrary to the concepts of Ramsey (1953) and Smith and Smith (1962).

However, no critical comparative study of *T. lineatum* has appeared since the reviews and comments by Smith and Smith (1952, 1953), and *T. mertensi* has never been reexamined in depth.

Access to 57 specimens (see Appendix) of the species, from the Texas Panhandle, has enabled us to evaluate the taxonomic status of populations of *T. lineatum* in that area. The specimens are from every county noted in Dixon (1987: 279), and from six others (Fig. 1).

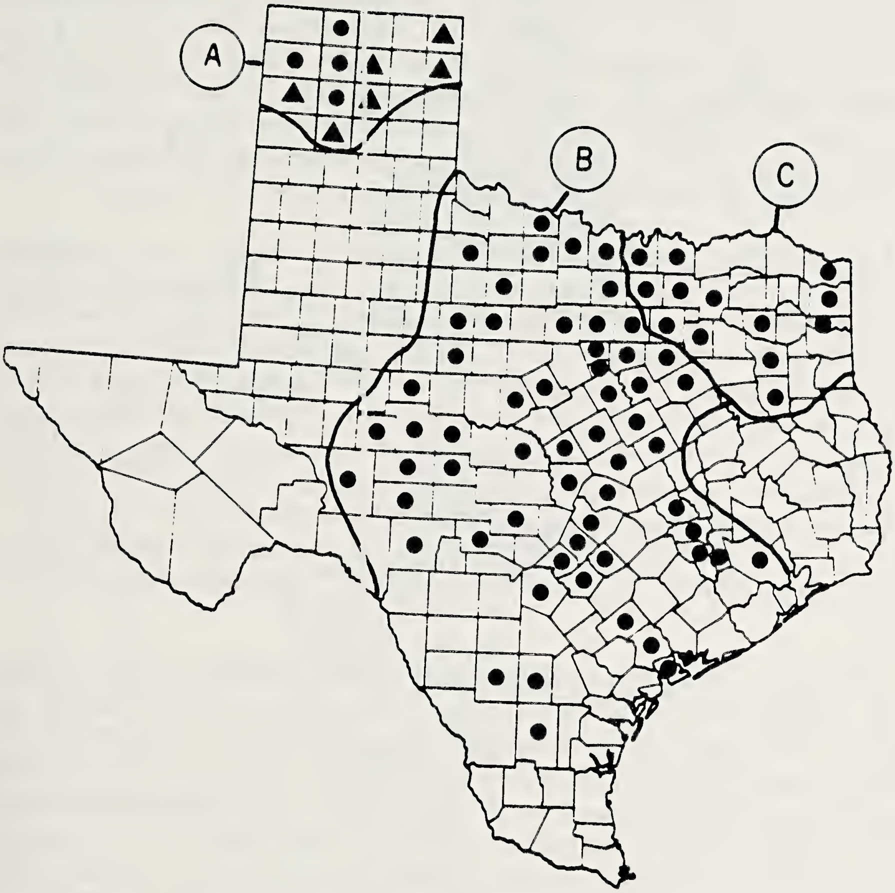

Fig. 1. Distribution of the subspecies of *T. lineatum* in Texas, as interpreted by Dixon (1987: 279), modified in the Panhandle region. A, *T. l. lineatum*; B, *T. l. texanum*; C, *T. l. annectens*. Triangles indicate counties of present record additional to those noted by dixon (round dots). Specimens were examined, however, from every county of record in the Panhandle.

Identity of the Panhandle Population

The diagnostic features of *T. l. mertensi* (from Smith, 1965) may be compared with the data (in parentheses) from the Panhandle series, as follows: in females, caudals fewer than 34 in 77% (60%), and ventrals minus caudals fewer than 106 in 82% (20%); in males, caudals more than 40 in 91% (61%), and ventrals minus caudals fewer than 98 in 82% (35%); in both sexes, minimum preanal scale rows 19 in 100% (80%). In none of these characters is the agreement of the Panhandle series with *T. l. mertensi*, as originally described, even as high as a 70% level, except for the last one, which is not diagnostic for any subspecies of *T. lineatum*. We thus conclude that the Panhandle population cannot be referred to *T. l. mertensi*.

It does, however, agree with *T. l. lineatum* in the most important characteristic distinguishing that subspecies, namely a relatively low number of ventrals, 144 or fewer. In the Panhandle series, the ventrals are fewer than 144 in 83% of 31 females (135-147, x̄=141), and in 91% of 26 males (136-145, x̄=140), and for *T. l. lineatum* Ramsey (1953) gives 81% in 35 females (135-148, x̄=141, and at least 94% in 32 males (135-148, x̄=139). In other, non-diagnostic criteria that differ significantly among the various subspecies of *T. lineatum*, the Panhandle series is in general agreement with the nominotypical subspecies, although the caudals tend to be fewer (40% vs 79% 34 or more in females, 39% vs 89% 41 or more in males) and the minimum preanal rows fewer (50% vs 85% 17 in females, 15% vs 67% in males.)

We thus conclude that the Panhandle population is properly referred to *T. l. lineatum*, along with all other populations of New Mexico and Colorado. That disposition conforms with Stebbins' (1966, 1985) allocations, and with Ramsey's (1953), Smith et al.'s (1965) and Hammerson's (1982) Colorado assignments. Numerous seemingly isolated populations are evident, probably relicts from a Hypsihygrous interval responsible also for eastern relicts of both *T. l. lineatum* and *T. l. annectens* (Smith and Smith, 1962, 1963). The preference of the species for high soil moisture is apparent by the large proportion of the specimens here reported, and that we are aware of otherwise, that was found in cities, towns, and elsewhere (even highway rest stops), where soil moisture is relatively high, due especially to frequent watering.

The nominotypical subspecies, so envisioned, thus spans the entire east-west range of the species, and most of the north-south range (Fig. 2). Hence current temperature or humidity-influenced developmental effects inherent in latitudinal and longitudinal differences are not likely to be responsible, directly or indirectly, for the differences here recognized as subspecific.

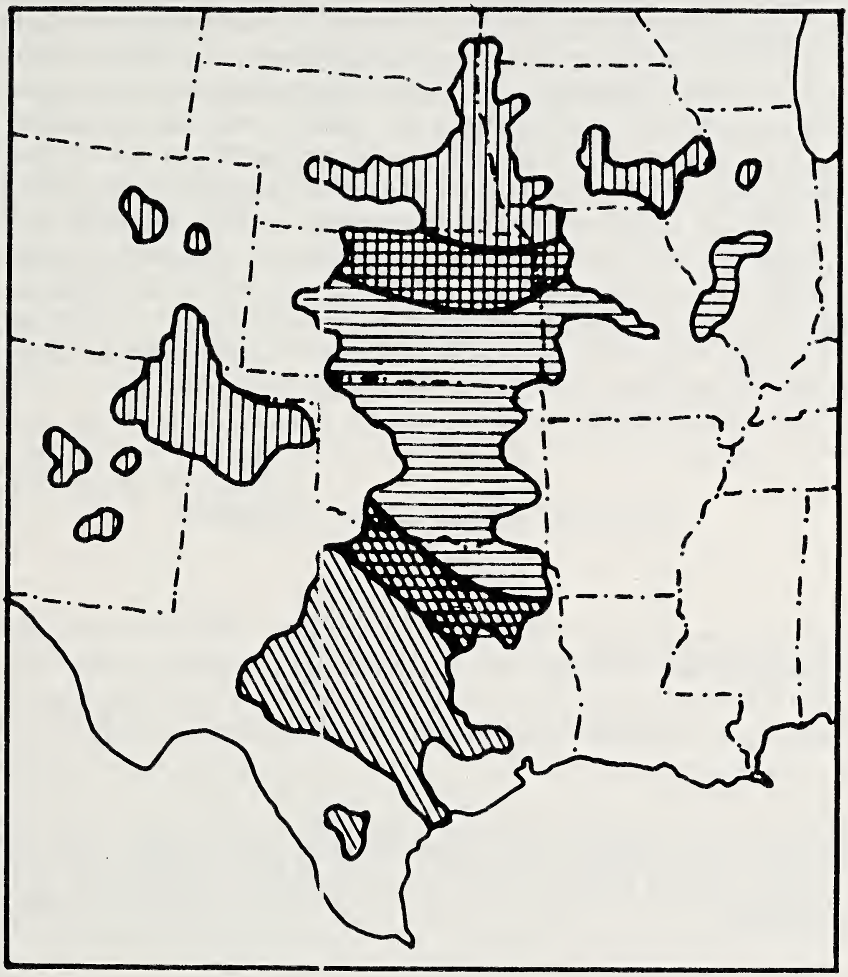

Fig. 2. Total distribution of the subspecies of *T. lineatum*, adapted from Conant and Collins (1991: map 139. Range of *T. l. lineatum* modified on the basis of specimens reported herein. Areas of intergradation from Smith and Smith (1962, 1963), in turn drawn largely from Ramsey (1953). Vertical lines, *T. l. lineatum*; horizontal lines, *T. l. annectens*; diagonal lines, *T. l. texanum*.

Status of *T. l. mertensi*

As originally characterized (Smith, 1965), *T. l. mertensi* was distinguished from other subspecies by acceptable percentages in four features, considering the sexes separately. Males were differentiated from each of the other three subspecies by one different character each, and females by one or two characters. However, the Panhandle series negates the validity of every one of those distinctions. On the other hand, the 39 types of *T. l. mertensi* agree better with the primary unique feature of *T. l. lineatum* (ventrals fewer than 144) than do even the series assigned to that subspecies (100% vs at most ~85%), and in several other respects (caudals, ventrals plus caudals, minimum preanal rows) it represents extremes of tendencies characteristic of *T. l. lineatum*, although not diagnostic. In all these respects *T. l. mertensi* differs strongly from both *T. l. annectens* and *T. l. texanum*, and agrees critically with *T. l. lineatum*. We accordingly conclude that *T. l. mertensi* is a junior synonym of *T. l. lineatum*.

Key to the Subspecies of *T. lineatum*

1. Ventrals plus caudals 178 or more in females, 185 or more in males (at most 28% of *lineatum* will fall here) 2

   Ventrals plus caudals fewer than 178 in females, 185 in males 3

2. Ventrals 144 or more in both sexes (females 94%, males 71%); ventrals plus caudals 178 or more in 89% of females, 185 or more in 82% of males .... *annectens*

   Ventrals 143 or fewer in both sexes (at least 81%) 3

3. Ventrals 144 or more in both sexes (at least 80%) .... *texanum*

   Ventrals 143 or fewer in both sexes (at least 80%) .... *lineatum*

Albinism

As Hensley (1959: 156) noted, Curtis (1949: 11) reported "A partially albinistic specimen, white with a pinkish pattern and blue eyes" of *T. lineatum* from Highland Park, Dallas Co., Texas. The present location of that specimen is unknown; it is no longer in the Dallas Zoo, nor is it in the KU museum. Another albino (now KU 180259), its degree of albinism not noted, was reported by Dyrkacz (1981: 25) from Dallas Co. (Farmers Branch, Brookhaven area) on the basis of a personal communication from Dr. James B. Murphy, who submitted that the specimen, then alive in the Dallas Zoo, was taken 25 April 1975 by Paul Moore. We are aware of no other records of albinos of this species, but here report a completely albinistic (i. e., leucistic; Dyrkacz, 1981: 3) specimen, apparently pink-eyed, with no trace whatever of pattern either dorsally or ventrally, from Hamlin, Jones Co., Texas (TTU 2218), taken 20 August 1960 by J. D. Johnson. It is a mature female, 291 mm total length, tail 39 mm. An intergrade between *T. l. annectens* and *T. l. texanum*, it has 15-17-13 dorsal scale rows (the fewest preanal scale rows recorded in the species; 15 was the previous minimum), 136 ventrals and 32 caudals.

Acknowledgments

We are much indebted to Dr. Steven Williams for the long protracted loan of specimens from the Museum, Texas Technological University; to Dr. Kathleen B. Blair for the privilege of studying material at the museum of West Texas A & M University; to Dr. Shi-Kuei Wu for permission to study material in the University of Colorado Museum; to Dr. James B. Murphy of the Dallas Zoo, and John E. Simmons and David Kizirian of the University of Kansas Natural History Museum, for help locating albino specimens previously reported of *Tropidoclonion*; and to Dr. William M. Lewis and Dr. Michael C. Grant for provision of research facilities in the Department of EPO Biology.

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Appendix

The 57 specimens here reported of *T. l. lineatum* from the Panhandle of Texas are as follows.

Carson Co.: Panhandle (WTAMU 10580-1, 10741, 10863); White Deer, Pophan St. (WTAMU 13991). *Hartley Co.*: 0.5 mi S Channing (TTU 1900). *Hemphill Co.*: Canadian (WTAMU 5277). *Hutchinson Co.*: Borger (WTAMU 11157, 13763, 13990); Fritch (WTAMU 3572-3); Stinnett (WTAMU 59891, 6022); 2 mi W Stinnett (WTAMU 14104-5). *Lipscomb Co.*: Darrouzett (WTAMU 14522). *Moore Co.*: 7.7 mi E Dumas (TTU 2674). *Oldham Co.*: Hy 1061 46.3 km W jct Hy 66 (WTAMU 968); Boys Ranch (WTAMU 14433). *Potter Co.*: Amarillo (UCM 56777, WTAMU 2442-4, 2446); Boys Ranch Road (WTAMU 12279); Hy 238 2 mi S jct Hy 1061 (WTAMU 5127); Hy 1061 8 mi N Hy 60 (WTAMU 5204); Hy 1061 15.7 mi NW Bishop Hills (WTAMU 2447);

Hy 1061 18 mi NW Hy 66 (WTAMU 920-1, 999, 1061-2); Hy 1061 21 mi NW Hy 66 (WTAMU 1028-9); Hy 1061 24.6 mi NW Hy 66 (WTAMU 1000); 5 mi W Soney (WTAMU 10953). *Randall Co.*: Amarillo (WTAMU 5683, 5816); 3 mi S Amarillo (WTAMU 10292); Camp Harrington, Hy 1541 3.5 mi N Hy 217 (WTAMU 2440-1, 7936); Canyon (WTAMU 12278); 1 mi E Canyon, Hy 217 (WTAMU 3587); 1.5 mi S Canyon, 200 yds W Hy 87 (WTAMU 13634); 4 mi W Canyon, Hy 1062 (WTAMU 10008); 0.25 mi E Ross, Hy 1151 (WTAMU 12381). *Sherman Co.*: 18 mi E Stratford (WTAMU 2662); 22.4 mi E Stratford (WTAMU 2663); 18.4 mi N Sunray (WTAMU 2664).

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SOME NEW DISTRIBUTION RECORDS FOR THE SNAKES OF EGYPT (SQUAMATA:SERPENTES)[1]

Kenneth J. Stein and Ibrahim M. Helmy

In 1992, a 5-year study was initiated to determine the distribution and ecology of the snakes of Egypt. Most specimens were captured, examined, photographed, and then released. Seven hundred and eight-five snakes representing 23 species were collected from 7 governorates in the Nile Delta and 1 governorate in Upper Egypt. Seventy-nine new distribution records were produced for both venomous and non-venomous species.

Some of the earliest herpetological studies in Egypt were conducted by the French. In the early 1800's, the French performed a comprehensive survey of the Egyptian flora and fauna and reptiles received a great deal of attention; one volume was devoted to their study (Geoffroy Saint-Hilare and Savigny 1813). Anderson (1898) conducted a much broader investigation of the Egyptian fauna, reporting on the taxonomy and distribution of 25 snake species. His monograph is unique insofar as it provides a vast amount of anecdotal information with regard to both snake behavior and habits. Flower (1933) reported that many of the distribution records described by Anderson (1898) may have been inaccurate and suggested that many of Anderson's specimens were either purchased or donated by friends. Flower (1933) attempted to emend the records of Anderson (1898), although Flower's locality descriptions were both vague and imprecise as well. More recently, Marx (1968) published a monograph which was the result of several studies conducted by NAMRU-3 during the 1950-60's. Marx (1968) included distribution records for his reported 35 species but failed to incorporate some records that were published in local journals. In addition, the similarity of habitats among the governorates of Egypt would suggest wider distributions for many of the species than he reported.

Since the work of Marx (1968), the human population of Egypt has nearly doubled and many previously undisturbed habitats have undergone urban development or have been converted for agricultural purposes (Center for population and mobilization statistics of Egypt. 1992). Human encroachment into these areas and the corresponding habitat disruption have undoubtedly had an impact on snake populations and their respective distributions. However, current published data with regard to the distribution and/or status of snake species in Egypt do not exist. Furthermore, Egypt does not have a herpetological society which maintains collection records for the various species.

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[1] The opinion and assertions contained herein are the private ones of the authors and are not to be construed as official or reflecting the views of the Navy Department, Department of Defense, or the U.S. Government.

The present study was undertaken to determine the snake species composition and distribution in various governorates of Egypt. Whereas previous studies have examined snakes from geographically close and ecologically similar areas, this study provides important distributional information for many species rather than mere collection localities. The information collected in this study also provides a taxonomic baseline for future studies and identifies specific areas where humans may be at increased risk of snakebite.

Material and Methods

Snakes were collected from 8 governorates in 1992 (Fig. 1). Ten days on average were spent collecting in various sites within each governorate. Temperature, humidity, and habitat information were noted. Most snakes were photographed, particularly unique color forms, and certain aspects of their behavior were recorded by video camera. All snakes were subsequently released the same day.

Most of the snakes reported in this study were located by following their tracks to abandoned rodent burrows (mostly *Gerbillus*, *Meriones*, and *Psammomys* spp.) from which they were excavated. Others were collected by overturning stones and large clumps of sod along irrigation canals which was followed by subsequent digging. All specimens were identified or verified by Mr. I. Helmy, Medical Zoology Division, NAMRU-3. Distribution records were compared with those reported by Anderson (1898), Flower (1933), Kamal et al. (1966a & b), Marx (1968), and Farid (1979).

List of Species[2,3]

LEPTOTYPHLOPIDAE

Cairo Earth Snake, *Leptotyphlops cairi* (Duméril, Bibron, and Duméril) (101)

Location: Giza Governorate-Abu Rawash (100); Suez Governorate-Suez (1)

Remarks: Common-tends to be local thus making it difficult to find. Typically found in cultivated fields, gardens, and under stones.

BOIDAE

Theban Sand Boa, *Eryx colubrinus colubrinus* (Linn.) (15)

Location: Giza Governorate-Abu Sir el Malg*

Remarks: Uncommon-found in sandy areas near cultivated land close to the desert.

Javelin Sand Boa, *Eryx jaculus jaculus* (Hass. in Linn.) (3)*

Location: Daqahliya Governorate-Temaii el Andid

Remarks: Uncommon-first record of this species from the Nile Delta. Found in sandy areas near cultivated land.

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[2] Numbers in parentheses represent total specimens collected.
[3] Asterisk (*) indicates new distribution record.

COLUBRIDAE

Flowered Snake, *Coluber florulentus* Geoffroy (18)

Location: Aswan Governorate-Khour El Tarfa (1)*; Beheira Governorate-Wadi el Natroun (1), El Gaar (1)*; Daqahliya Governorate-Gamasa (2)*, Semballawen (3)*; Giza Governorate-Abu Rawash (2); Ismailia Governorate-El Manaief (3)*, El Ganaien (5)*.

Remarks: Common-often encountered in houses in villages. Frequently found near irrigation canals, semi-desert areas, and in sandy areas near cultivated land.

Jan's Desert Racer, *Coluber rhodorhachis rhodorhachis* (Jan) (1)

Location: Suez Governorate-El Kattamiya*

Remarks: Common-found in semi-desert/sandy areas and is often associated with desert plants and shrubs. Also found under stones.

Rogers' Snake, *Coluber rogersi* (Anderson) (1)

Location: Beheira Governorate-Wadi el Natroun, El Hamra*

Remarks: Common-typically found in open sandy areas, in hillocks under palm trees, and in burrows of *Gerbillus*.

Crowned Leaf-Nosed Snake, *Lytorhyncus diadema* (Duméril, Bibron, and Duméril) (5)

Location: Giza Governorate-Bahariya Oasis, El Hara (3)*, Ain Maroun (1)*; Ismailia Governorate-El Karnak (1)*

Remarks: Common to uncommon-found in semi-desert/sandy areas with thick vegetation (desert plants), near irrigation canals, and also in cultivated land.

Mediterranean Hooded Snake, *Macroprotodon cuccullatus* (Geoffroy) (8)

Location: Giza Governorate-Abu Rawash (4)*; Ismailia Governorate-Ismailia (4)*

Remarks: Common to uncommon-found in sandy areas with shrubs and heavy vegetation, and in rodent burrows.

Moila Snake, *Malpolon moilensis* Reuss (2)

Location: Giza Governorate-Bahariya Oasis, El Hara (1)*, Ain el Wadi (1)*

Remarks: Common-can be found in a variety of habitats such as sand dunes near salt marshes, edges of cultivated land near semi-desert, and in rodent burrows.

Montpellier Snake, *Malpolon monspessulanus insignitus* (Geoffroy) (7)

Location: Daqahliya Governorate-Gamasa (3)*; Giza Governorate-Bahr el Geer (2)*; Port Said Governorate-Ashtom El Gamiel (1)*, Bahr El Bakkar (1)*

Remarks: Common-typically found throughout the Nile Delta, coastal semi-desert, salt marshes, near irrigation canals and wetlands. Not found in the desert.

Tessellated Water Snake, *Natrix tessellata* Laurenti (108)

Location: Daqahliya Governorate-Abu Maadi (1)*, Dekernis (1)*, Gamasa (1 *, Semballawen (2)*; Giza Governorate-Abu Rawash (20)*, El Mansuriya (30)*, Kafer Hakim (20)*, Nahya (19)*; Ismailia Governorate-15 km. NW, Ismailia-Salhiya Rd (3)*, El Ganaien (4)*; Kafr el Sheik Governorate-Ibtu (3)*; Port Said Governorate-Bahr El Bakkar (4)*

Remarks: Common-found in salt water marshes, near irrigation canals, wetlands, and in cultivated land.

Schokari Sand Snake, *Psammophis schokari schokari* (Forskal) (4)

Location: Beheira Governorate-Wadi el Natroun (5 km. W of Bir Hoker) (3), El Gaar (1)*

Remarks: Common-can be found in semi-desert areas, near irrigation canals, and in sandy areas near cultivated land.

Saharan Sand Snake, *Psammophis schokari aegyptius* Marx (53)

Location: Giza Governorate-Bahariya Oasis, Bir el Mataar (2)*, El Haiz (1), Ain Riech (2)*, El Hara (1), El Ewena (2)*, Gobala, El Magrabia (1)*; Daqahliya Governorate-Ezbet el Omda (1)*, Semballawen (2)*; Giza Governorate-Abu Rawash (12)*, El Mansuriya (10)*, Kefer Hakim (13)*; Ismailia Governorate-El Manaief (1)*, Ismailia (2)*; Suez Governorate-Suez (2)*, Wadi Hagoul (1)*

Remarks: Uncommon-found in semi-desert areas and in uncultivated land.

African Beauty Snake, *Psammophis sibilans sibilans* (Linn.) (29)

Location: Aswan Governorate-Ballana Nwal Village (2)*; Beheira Governorate-Bir Hoker (1)*, Kafr Dawood (1)*; Daqahliya Governorate-Gamasa (1)*; Giza Governorate-Abu Rawash (4), El Mansuriya (2), Gerza (10)*, Kafer Hakim (8)

Remarks: Common to uncommon-not difficult to find; found in cultivated land but more commonly collected in semi-desert areas. Also collected from farm houses in villages.

Clifford's Snake, *Spalerosophis diadema cliffordi* (Schlegel) (6)

Location: Giza Governorate-Bahariya Oasis, Gabel El Tibniya (1)*; Ismailia Governorate-15 km. NW, Ismailia-Salhiya Rd (5)*

Remarks: Common-typically found in open sandy areas, in hillocks under palm trees, near irrigation canals, and in both rockpiles and gardens.

Egyptian Cat-Snake, *Telescopus dhara obtusus* (Reuss) (1)

Location: Ismailia Governorate- El Taawin Beach (1)*

Remarks: Common-often collected in buildings, both in the city and in rural villages. Also found in cultivated and uncultivated land with dense shrubs and other vegetation; sandy areas.

ELAPIDAE

Egyptian Cobra, *Naja haje haje* (Linn.) (108)

Location: Daqahliya Governorate-Temaii el Andid (2)*; Giza Governorate-Abu Ghalieb (1), Abu Sir (2)*, El Mansuriya (100), Nahya (2)*; Kafr el Sheikh Governorate-Ibtu (1)*

Remarks: Common-found in the Nile Delta and along the Nile, southward to Minya and Assuit. Collected in semi-desert areas, salt marshes, uncultivated areas with heavy vegetation, and near irrigation canals. Prefers the burrows of *Psammomys* spp. This species also inhabits cemeteries in Delta villages and historic ruins as well.

Spitting Cobra, *Naja nigricollis nigricollis* Reinhardt (1)

Location: Aswan Governorate-Naga el Kubaniya (1 skin)*

Remarks: Common-semi-desert areas, cultivated land, in villages, and historic ruins of Upper Egypt.

Innes' Cobra, *Walterinnesia aegyptia* Lataste (1)

Location: Suez Governorate-Wadi Hagoul (1; 2 fresh tracks)*

Remarks: Rare-typically found in the open desert; in wadis with moderate to heavy vegetation.

VIPERIDAE

Horned Viper, *Cerastes cerastes* (Linn.) (178)

Location: Aswan Governorate-Abu Simbel (26)*, Garf Hussein (6)*, Khour El Tarfa (45)*; Giza Governorate-Bahariya Oasis, El Haiz, Ayun el Tablamon (4)*, Dahshur (2)*; Ismailia Governorate-20 km, NW, Ismailia-Salhiya Rd. (4)*; Suez Governorate-Wadi Doum (6), Wadi Hagoul (6)*, Wadi Araba (50)*, Wadi El Ghewaba (28)*, Bir Qena (1)*

Remarks: Common-a desert species found in wadis, salt marshes and wetlands, under rocks, and in rodent burrows. This species prefers to rest in sand, especially in the shade of rock outcroppings or vegetation.

Lesser Cerastes Viper, *Cerastes vipera* (Linn.) (63)

Location: Beheira Governorate-Wadi el Natroun (1)*; Giza Governorate-Bahariya Oasis, Bir el Mataar (1)*, El Haiz, Ayun elTablamon (4)*, Dahshur (6)*, Zawiet Abu Mesalem (1)*; Suez Governorate-Bir Qena (8)*, Wadi El Gewaba (42)*

Remarks: Common-a desert species found in wadis, salt marshes and wetlands, under rocks, and in rodent burrows. This species also prefers to rest in the sand, in the shade of rock outcroppings or vegetation.

Carpet Viper, *Echis carinatus* (Schneider) (71)

Location: Giza Governorate-Bahariya Oasis, Ain Maroun (3)*, Gabel El Tibniya (68)*

Remarks: Common-the Oases of Siwa, Bahariya, and Fayoum. Found in semi-deset near cultivated land, in sandy hillocks under palm trees, and in gardens.

Burton's Carpet Viper, *Echis coloratus* Günther (1)

Location: Suez Governorate-Wadi el Gallala el Bahariya (1)*

Remarks: Rare-Eastern Desert; in wadis with moderate to heavy vegetation.

Results and Discussion

Seven hundred and eighty-five snakes representing 23 species were collected from 7 governorates in the Nile Delta region and one governorate (Aswan) in Upper Egypt (List of Species). This number represents 2/3 of the total number of species (35) that have previously been reported from Egypt; 7 of these species accounted for approximately 88% of the total number of specimens collected. These percentages (including *L. cairi* (13%), *N. tessellata* (14%), *P. schokari aegyptius* (7%), *N. haje haje* (14%), *C. cerastes* (23%), *C. vipera* (8%), and *E. carinatus* (9%)) reflect both the ease by which these species were found as well as the experience of the collectors. However, we assume that each species has an equal probability of being collected (by habitat/region); therefore, these data in fact suggest a measure of relative abundance for each species collected.

While previous herpetological studies have been conducted in Egypt, many locations have not yet been surveyed. Future studies will undoubtedly produce new distribution records and, perhaps, reveal the presence of new species or those not having been reported since the early 1800's. Accordingly, the information generated from this and future studies will yield a database of value to conservation and herpetological societies, and health officials involved in determining health risks from venomous snakes in this part of the world. Furthermore, this database will also be important in improving treatments for snakebites, as well as identifying the need for specific antivenoms which at present are not always readily available.[4]

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[4] Some antivenoms are effective only if prepared from venoms of same geographic taxonomic group; e.g., *Echis* spp. (AFMIC 1991).

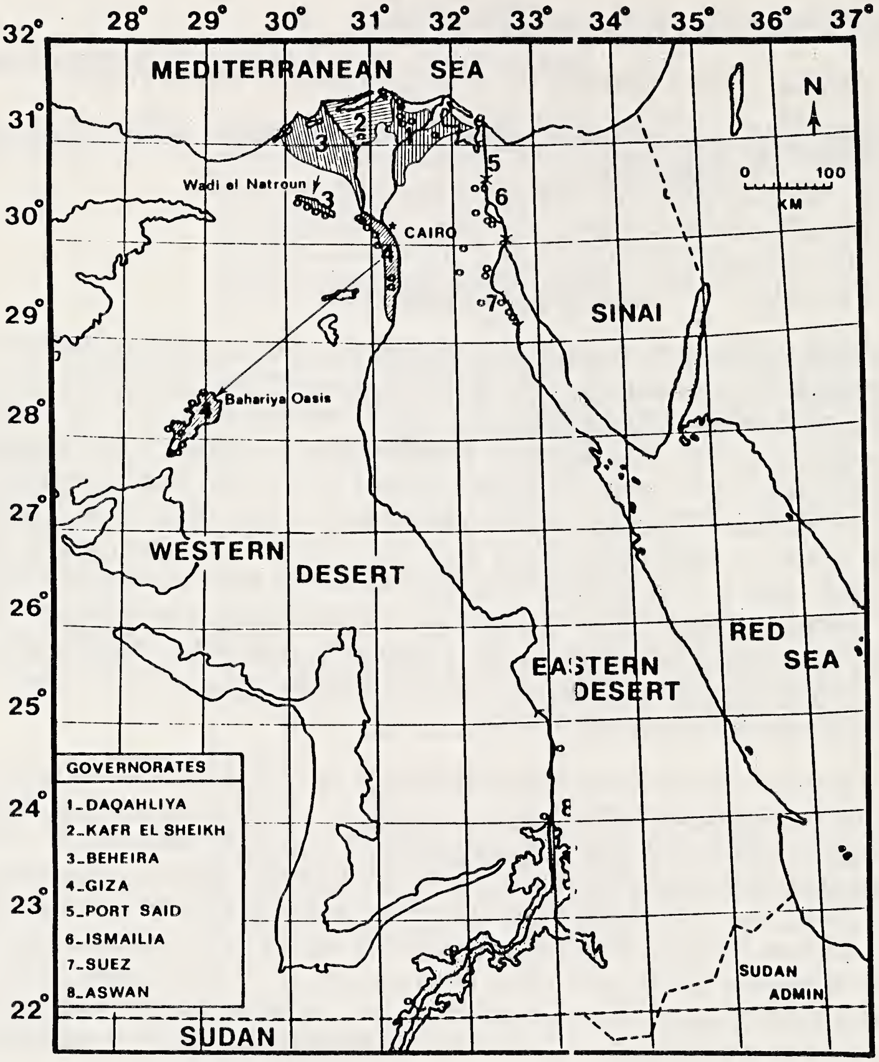

Fig. 1. Snake collection localities in Egypt.

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NEW HERPETOLOGICAL DISTRIBUTION RECORDS FROM MARYLAND'S EASTERN SHORE

The following new records of some rarely encountered amphibians and reptiles from the Eastern Shore (Lower Coastal Plain) of Maryland, were discovered since the publication of the distributional survey by Harris (1975). Scientific and common names follow Conant and Collins (1991).

Notophthalmus viridescens (Red-Spotted Newt). Two adults were found by Frank Hirst in Worcester County during late April 1975 in a small pond N of Rattlesnake Landing off of Scott's Landing Rd., 3 km SE of Boxiron. These specimens were immediately released by Hirst at the capture site and are the first report of this species from Worcester County (Harris 1975). With the recent records by Miller (1984) from Dorchester County and Grogan (1985) for Wicomico County, this leaves only Queen Annes and Somerset as the only counties in Maryland with no records of this species (Harris 1975).

Hemidactylium scutatum (Four-Toed Salamander). During late March 1986, I discovered an adult underneath sphagnum in an overgrown borrow pit N of the junction of Twilley Bridge Rd. and Fooks Rd., 4 km SE of the Salisbury Wicomico Airport, Wicomico County. This specimen was immediately released at this site and is apparently only the second record of this species from Wicomico County (Harris 1975).

Gastrophryne carolinensis (Eastern Narrowmouth Toad). Three adults (Fig. 1) were found in Worcester County by my son C. B Grogan, 30 June 1990, under debris in a sandy depression E of Colbourne Mill Rd, 1.5 km S of the Wicomico County line. These specimens, only the second record for Worcester County, fed readily on ants and termites in captivity until their release at the capture site on 27 September 1990. Since this locality is only 4 km N of the locality where two juveniles of this species were found by Czarnowsky (1975), it is possible that these specimens are part of the same population.

These Worcester County specimens were found near Nassawango Creek, a tributary of the Pocomoke River. Since the Pocomoke River originates 12 km N of the Maryland border in Delaware, it is likely that this species may also eventually be found to occur in the Pocomoke watershed in Delaware.

Trachemys scripta elegans (Red-Eared Slider). This feral species was reported by Harris (1975) and Conant and Collins (1991) from a broad central region of the Western Shore of Maryland. It is also now feral on the Eastern Shore in the Wicomico River and in at least one impoundment (Johnson Pond) of that watershed in Salisbury, Wicomico County. During the last 12 years I have observed specimens sunning on logs and bulkheads in the Wicomico River, often alongside their more common relatives, *Pseudemys rubriventris* and *Chrysemys picta*. I have captured and examined adults, immatures and hatchlings, an indication that this species is well established and reproducing in this estuary. Individuals have been observed actively swimming and sunning even on warm winter days as early as 2 February 1989.

Eumeces laticeps (Broadhead Skink). An adult female was taken on 7 September 1989 at Shad Landing State Park, Worcester County by a park visitor. This specimen, with a snout-vent length of 86 mm and total length of 226 mm, was found in the same area of Shad Landing as the male reported by Grogan (1985). An additional specimen from Worcester County was found by Frank Hirst during August 1990 as it was crossing Brantley Rd., 1 km W of its junction with Sheephouse Rd., approximately 3.5 km N of the Maryland-Virginia line. This adult male with a snout-vent length of 130 mm and total length of 257 mm, exceeds the length of a specimen (s-v 120 mm) reported by McCauley (1945) as the largest Maryland individual, and represents the southernmost record in Maryland (Harris 1975). Both of these specimens are deposited in the vertebrate collection at Salisbury State University.

Elaphe guttata (Corn Snake). McCauley (1945) recorded this species from the vicinity of Salisbury, Wicomico County, from a report by E. K. McIntosh, a teacher at Wicomico High School who told McCauley that students frequently brought specimens to him. Harris (1975) indicated that McCauley's (1945) locality is the only one known of this species from Wicomico County. A recent visit to Wicomico High School revealed that indeed several large corn snakes are in their collection of preserved biological specimens. During the last 15 years, residents of Salisbury have occasionally brought me either live or freshly killed corn snakes, two of which are now preserved in the vertebrate collection at Salisbury State University. More recently, a Salisbury resident, Stephen Mach, related that between 1990-92 at least 12 individuals of this species were found by him and others in Salisbury in an area on the E side of Johnson Pond from Brewington Branch extending N to Naylor Mill Rd. This area has extensive loblolly pine with mixed hardwoods and loose sand, habitat preferred by this often fossorial species. One of the females taken by Mach in 1991 laid 12 eggs, 8 of which hatched in September of that year and the hatchlings released. These recent specimens indicate that a sizeable population still exists in a region of Salisbury that is highly developed.

An additional specimen, an adult female was found by C. B. Grogan in late October 1980 under a board at Walston, N of the junction of MD 346 and Walston Switch Rd. This specimen was released a few days later at its capture site. This is only the second known locality of this species in Wicomico County (Harris 1975), and is approximately 6.5 km ESE of the specimens reported above from Salisbury.

Cemophora coccinea (Scarlet Snake). A large (ca. 450 mm total length) specimen was found by Michael J. Geiger on 25 May 1991 under sheet metal at Millville, off of Old Stagecoach Rd. N of Md. Rt. 12. This specimen (Fig. 2) was photographed and released a few days later at the capture site. This is the second record of a scarlet snake from Worcester County (Grogan 1985) and only the third known specimen from the Eastern Shore (Harris 1875). Arndt (1985) reported upon the only known specimen of this species from Delaware, which was taken at Trap Pond, Sussex County during June 1963, and is now in the Carnegie Museum (CM 108993).

Agkistrodon contortrix (Copperhead). Harris (1975) indicated that copperheads are distributed statewide in Maryland "except for the central section of the Eastern shore". He plotted two records of this species in the western section of Dorchester County but stated that these records are doubtful since "specimens are thought to have been accidently introduced via the canning industry there". Arnold Norden (personal communication) recently advised me that E. Mowbray had acquired several interesting herpetological specimens from Dorchester County while he was employed at the Horn Point Environmental Laboratory (HPEL) between 1972-75. Through the courtesy of Cathy Baptist, Environmental Education Specialist at HPEL, I was able to examine Mowbray's material which contained two copperheads from Dorchester County, an adult female taken 20 July 1975 by Tom Tyler at Henry's Crossroads, 10.5 km S of Vienna, and an adult male collected by E. Cannon, September 1978 on Bucktown Rd. (S of Cambridge). Baptist told me that during 1986 a native of Church Creek (12 km SW Cambridge) brought her a copperhead that he had killed. Recently, Peter H. Wanner observed an adult undergoing ecdysis on 27 July 1993, 2 km W of the junction of New Bridge Rd. and Ravenwood Rd., 3.5 km SW of Salem, Dorchester County. In view of the fact that copperheads occur in adjacent Delaware in Sussex County (Arndt 1985) and in Wicomico County, MD (Harris 1975; Grogan, personal observations), these new records indicate that they are widely distributed in Dorchester County and probably represent natural populations. Although there are no records of copperheads from Caroline, Kent, Queen Annes or Talbot counties (Harris 1975), this species may occur in at least some of these counties since I recently received unsubstantiated reports of three specimens found in western Kent County, Delaware during the summers of 1992 and 1993 (D. Rothstein, personal communication).

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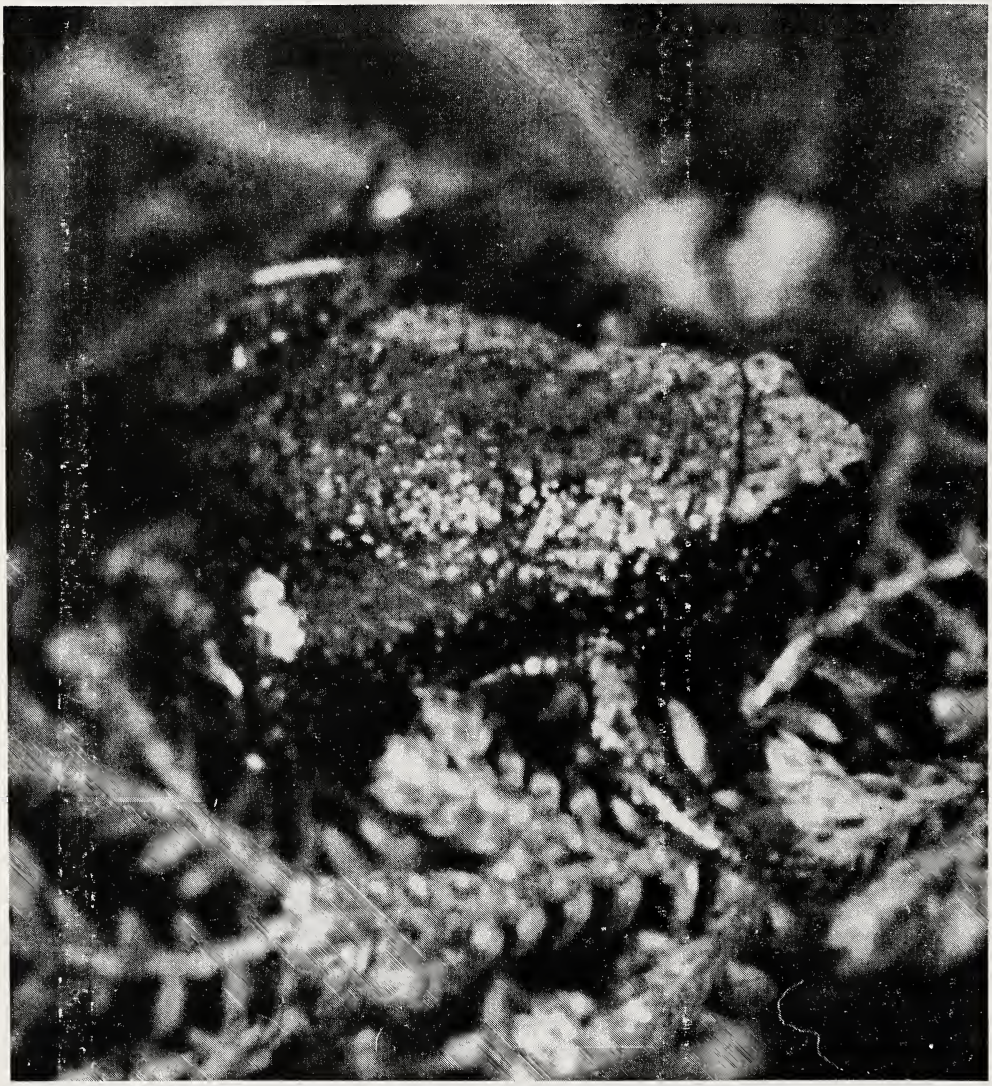

Fig. 1. Adult *Gastrophryne carolinensis* from Worcester County, Maryland.

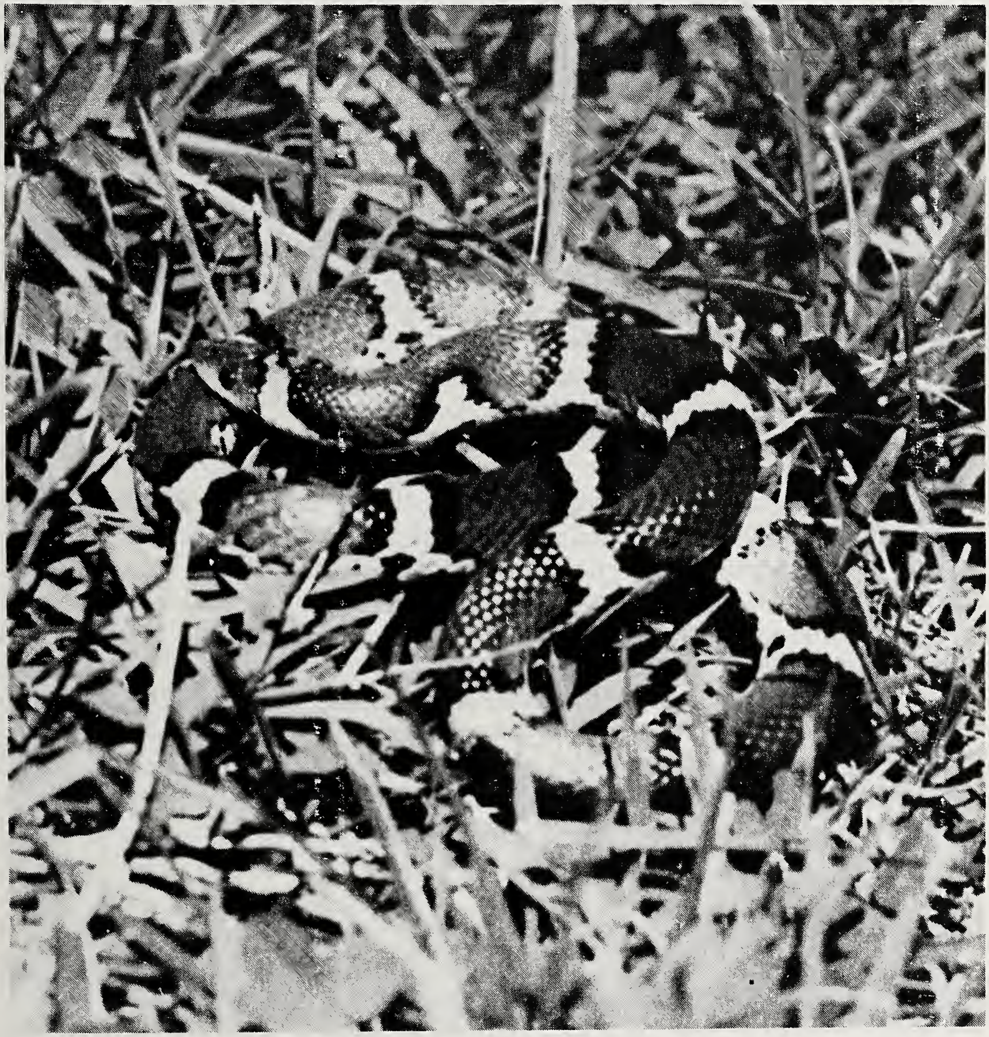

Fig. 2. Adult *Cemophora coccinea* from Worcester County, Maryland.

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OTTYS ELONE SANDERS: A MULTITALENTED MAVERICK SCIENTIST

Maverick: "a person who takes an independent stand apart from his associates, after Samuel A. Maverick, Texas pioneer." So defined, just such a person was Ottys Sanders (April 25, 1903-March 13, 1993), in almost every conceivable way: a Texan throughout life, born in the little town of Hubbard (formerly Slapout), and with given names of no known origin, appearing in no lexicon consulted. Rarely did Ottys use even his middle initial in any of his writings, and never, so far as I am aware, his full middle name. It was, indeed, hardly necessary for identification, for the first name alone was unique. Quite likely it was Ottys' father, Julius Claudius Sanders, who was responsible for Ottys' given names. Julius was a business man, but the family had a good library in which Ottys and his sister Nadine (whom he loved dearly and was five years younger, but who preceded him in death) as well as his father, and mother, Loula E. Fain Sanders, read extensively, obtaining a good knowledge of classical literature.

It seems unlikely that his given names materially affected his personality, but certainly they were made for each other. Although perfectly capable of deep affection and loyalty, those sentiments were sparingly exercised. He was devoted to his wife, Ruth Maxwell Sanders (1906-1985), whom he married August 8, 1930; her very sudden death in a hair-dresser's shop was a shock from which he never fully recovered. She was a vital partner, instrumental in the success of his business - The Southwestern Biological Supply Company - for its entire duration of over 50 years, helping in every facet of its operation. Her artistic talents led her to making biological models, illustrating publications, catalogs and fliers, and ultimately to a degree and career in medical illustration. She also complemented Ottys' writing and poetical talents. They had much to share, and through it became totally devoted to one another. Although there were no children, Ottys' letters to me occasionally revealed what I understood as regret.

Dr. Bryce C. Brown and I were the only herpetologists Ottys regarded as close friends for any length of time. We first met in 1947 when I taught for a year at Texas A & M University, and we continued corresponding until his death, especially frequently after 1979, when he closed his business. We shared a number of publications, mostly based on material he collected.

But, in general, academic and institutional types turned him off, at least in part and perhaps primarily because he did not respect their knowledge, work habits or personality, all interrelated. A few exceptions he did admire, but he had little patience with either incompetence as perceived, or lack of at least a little understanding of his own worth, from either administrators (especially) or professional colleagues. For example, in response to a cartoon I once sent to him portraying a receptionist questioning whether an applicant for a reservation was merely a Ph.D. or a "real" doctor, he replied that "you cannot draw me into a discussion about Ph.D.'s and M.D.'s. The quantity of lousy ones I have known is too overwhelming" (letter, 25 Jan. 1991). Again, on 16 October 1991 he wrote that "I view myself as one who had great ambition but turned out only to be mediocre. I never pursued a single course...and have never been accepted by my contemporaries. I am at the stage where it no longer makes any difference and care not at all for ill opinions. I seek peace but don't expect to find it, for there is something in me that continues to revolt. To write a successful novel or other work, one would have to care for people. I once probably did so, but this is no longer the case. The general multitude I despise, and owe them nothing. I am sorry if this displeases you, but that is the way things are. I feel that though I have tried, I have met nothing but defeat." Such bitterness is perhaps not uncommon among the elderly who take their setbacks seriously; at any rate it seems to have been unshakeable so far as Ottys was concerned.

It is indeed highly likely that his innate independence, even aloofness, was amplified greatly over time by the lack of respect he garnered from his academic colleagues, to a significant degree because he was an outsider invading their realm. Ottys was blessed with a sharp intellect, diverse talents and a workaholic drive, as well as a broad biological interest. Inevitably he made many new discoveries, some of which he put on record, but his perception of a cool detachment with which they were received by most of the intellectual colleagues in academia who were important to him was a gradually exacerbating disappointment. Similarly, his tremendous effort to make his biological supply company the best in the business was not overly successful; he had much difficult in bucking the long-established, well-known concerns, and was disillusioned by fickle customers. It is not surprising that as a result of these difficulties Ottys became quite bitter as time went on, for his psychological and physical investment was complete. He withdrew almost completely from the scientific world in his retirement, seeking solace mostly by composing poetry. It was almost in defiance that he wrote his three unpublished manuscripts in recent years: a history of the first twenty years of the Texas Herpetological Society, a resume of 52 years in his business, and, at my behest, an autobiography that leads up to his business years (see Bibliography).

There is plenty of evidence that Ottys was not always the extreme maverick - almost a hermit - seen in his last decade or so. He was a highly social person in his youth, and at least tried to counteract any innate shyness. Near his 18th birthday he reflected in his diary that "I don't see why I am of so timid a nature, sluggish and awkward. People are so queer and I am so queer myself that I am unable to analyze the situation" (Sanders, 1988, ms). Yet he was very active in church affairs, where he played the violin, and in the university (Southern Methodist, since his family moved to Dallas in 1919 so that both children could attend that school), forming many friendships with his peers, both boys and girls, and attending many social events. There was a glorious Mandolin Club trip that he shared in between semesters of his sophomore year at SMU, and a week's hitchhiking tour, part with a friend, after his sophomore year, involving many amicable associations with friends old and new, and with previously unknown hosts and car drivers. Effective social interchange seemed to be no problem.

The same was true of the early years of his business, when Ottys was very active in numerous scientific organizations. He was a founder of the Texas Herpetological Society (1939), attended their annual meetings for several decades, and served as Secretary from the beginning through 1948. He was a member of the American Association for Advancement of Science for many years; since no one on the SMU faculty was a member in those early years, it fell to his lot to arrange for the 1944 AAAS annual meeting in Dallas. He joined the Texas Academy of Science in 1930 and remained a member until at least 1961, during which time he held a number of offices and chaired several meetings. His association with the Academy ceased when it unconscionably refused to permit his company to compete with others in supplying materials to various state schools.

The short-lived (1920?-1975) North Texas Biological Society he seemed to enjoy more than any other. It "held the outstanding biological meetings in Texas, with excellent programs far exceeding the quality of those of the Texas Academy and, above all, the atmosphere was friendly" (Sanders, 1988 ms.). In this society Ottys served at least once as President, and on various committees, developing "friendships as one would in a large family" (op. cit.). The informality as well as intellectual merit represented in the Society appealed greatly to Ottys; there was no constitution and control was completely in the hands of dedicated committees. The Society expired through losses of its leaders and in competition with the Academy for the time of its members.

Still other organizations in which Ottys was active for a time were the Texas Entomological Society, National Association of Biology Teachers, Audubon Society, Dallas Ornithological Society and Texas Nature Federation.

These professional associations, as well as his many personal contacts otherwise, suggest that although Ottys was a brilliant person with the highest personal standards of performance, he was never secure in self-esteem, nor was he very tolerant of perceived shortcomings in others; he was neither conciliatory nor forgiving. Thus as time passed his alienation from others gradually increased until his "independent stand apart from his associates" became almost complete, and he almost a hermit.

Graduation from SMU in 1924 was followed that fall by candidacy for a master's degree in microbiology at the University of Chicago. There he became deeply involved with the very considerable poetry crowd, including Carl Sandburg and other notables, building upon his extensive record already forged at SMU and earlier, including a number of awards. Life in Chicago was extremely difficult for him, however, because he had to earn almost all of his way; his parents could not provide much of his needs. He thus worked at whatever jobs he could find to earn his keep, all the while attending classes, studying and spending time with his poetic interests. He sold some poetry, reviews and articles to magazines and newspapers, and even served briefly as a Brink's guard, revolver and all. Other jobs were with a fruit company's display, a poetry magazine, as a bodyguard for a prominent lawyer who was a double amputee (legs), and most important of all, General Biological Supply House, which served as a model, both negative and positive, for the business that Ottys later started.

After the fall term at the University of Chicago, Ottys returned home and then in early 1925 visited New York, via boat from Galveston. The intent was to explore the possibility of transferring to Columbia University. That did not materialize, but much time was spent sight-seeing and hob-nobbing with poets. Finding no place for himself in New York, he returned to the University of Chicago for the spring, 1925 semester.

One year was all he could manage in Chicago, however. The master's degree was never completed. After the spring, 1925 term, he hitchhiked to Dallas by way of Cincinnati, Ohio (to meet a friend with whom he completed the trip) and immediately started his biological supply business there, initially in his parents' home and in a very modest way. He had the help of Ruth, who participated fully with the enterprise, although they could not afford to get married for five more years.

Although Ottys had been repeatedly urged to make a career of poetry, he envisioned a more remunerative and satisfying life in biology, which had long appealed to him. In high school he made a rather large collection of butterflies, which he exhibited, and mounted a bat skeleton. It was through the influence of his experience at general Biological Supply House in Chicago, and in operation of his own supply company, 1925-1979, that the rapidly acquired his extraordinary breadth of biological knowledge, both plant and animal. He freely sought the help of taxonomic experts, soon learning thereby overwhelming details of biodiversity. In the process he became one of the very rare breed of naturalists at home pretty much throughout the plant and animal kingdoms. Very few people in the world could match such breadth of nomenclatural familiarity in biology.

Receiving special attention were marine algae, mosses, fungi, liverworts, many spermatophytes, bryozoans, hydroids, anemones, jellyfish, flatworms, roundworms, earthworms, leeches, slugs, snails, crustaceans of various sorts, spiders, mites, ticks, barnacles, parasites of many kinds, fishes, and of course herps. The many collections of almost infinite variety that he sent to widely scattered specialists in USA and Europe contained many new species and new distributional data. Ottys is thereby honored by eponyms of at least two spiders (*Trochosa sandersi* Gertsch, *Gnaphosa sandersi* Gertsch), one very strange earthworm (*Diplocardia sandersi* Gates), and one frog (*Hyla versicolor sandersi* Smith and Brown, actually a valid species but suppressed by decree of the International Commission on Zoological Nomenclature in order to validate a name proposed much earlier by Cope that was long applied to the same species, although wrongly until ICZN action was taken).

Ottys named and described at least one jellyfish (*Pelagia noctiluca mexicana* O. Sanders and R. Sanders, 1963), one frog (*Rana berlandieri brownorum* Sanders, 1973, now *R. brownorum*), and six toads, including *Bufo debilis retiformis* Sanders and Smith, 1951 (now *B. retiformis*); *B. woodhousii velatus* Bragg and Sanders, 1952 (still recognized by some, not by others); *B. houstonensis* Sanders, 1953 (well recognized and of considerable fame as a severely threatened species); *B. hobarti* Sanders, 1987); *B. antecessor* Sanders, 1987; and *B. planiorum* Sanders, 1987. The last three species, unlike the others, involve such iconoclastic views of phylogeny and taxonomy, and such uncertainty of discrimination, that they have not been assimilated into current concepts. They remain at present as flies in the ointment of convention; their significance is likely to remain unsettled for years. They are too solidly proposed to be dismissed out-of-hand, yet they are areas yet of too uncertain a quantity to be accepted out-of-hand.

The problems relative to Ottys' concepts in *Bufo* arise primarily from his extensive dependence on osteological characters, about which he wrote extensively, and from his conviction that hybridization has been an important factor in the phylogeny of North American members of the genus. Infatuation with that conviction is not, certainly, without a great deal of circumstantial support, inasmuch as interspecific fertility in the genus is extremely extensive; species isolation depends less upon intrinsic mechanisms than upon extrinsic ones, e.g. size, behavior, sound discrimination, time and circumstances of breeding, and geographic isolation. It is to be expected under those circumstances that hybridization events, when extrinsic mechanisms of isolation break down, could have a major influence on population lines and phylogeny. It was a door that Ottys was maverick enough to open, but through which his colleagues are reluctant to look, and understandably so: the view is frighteningly unintelligible.

Yet this is undoubtedly Ottys' greatest contribution to science, among the many he made in numerous fields. Another very substantial although virtually unknown contribution in herpetology was his chapter on the "Class Amphibia" in a textbook of zoology by G. E. Potter. Unfortunately it was, in effect, hidden from the beginning under a bushel; as a separate work it would have elicited widespread interest, for it is an exceptionally thorough, sound, popular account with many original illustrations by his wife. Natural history, classification, anatomy, and development were all covered in some detail, with emphasis upon North America.

Ill health plagued Ottys throughout the last few years of his life. His vision became so impaired that he was reluctant to drive and was to a considerable extent dependent on others, especially La Dene Stone, an elderly lady living in Dallas who faithfully monitored Ottys' welfare, for getting around. He nevertheless managed to keep his considerable acreage adequately mowed, sometimes with help, noting from time to time the tragic disappearance of the terrestrial life that once abounded there, to a considerable degree due to the proliferated fire ants. His hearing became severely impaired, making conversation difficult. Various other deteriorations of health continued, culminating in early March 1993, with severe signs of cardiac deficiency, for which he was hospitalized. He died there shortly thereafter, only some six weeks from his 90th birthday.

In brief, Ottys Sanders was an exceptionally talented and industrious scholar who contributed significantly to the growth of biological knowledge across the board, far more extensively than most biologists, and who will enliven herpetology with his highly original propositions for many years to come. He surmised correctly, I think, when he wrote in his unpublished autobiography (1988) that the right decision was made for a career in biology and business, over one in poetry, because his "Evolutionary hybridization and Speciation in American Indigenous Bufonids will live far longer than any poems I might write."

Acknowledgments

Drs. Calvin Smith and David Lintz of the Strecker Museum, Baylor University, provided invaluable aid in obtaining information from the Sanders files, and the photograph reproduced herewith. Dr. Lintz advises that the Museum has been a beneficiary of Ottys' ever since his appointment there in 1966 as a Research Associate. In recognition of his many monetary, scholarly and material contributions, "and as a memorial to him and his wife, a resource center is planned in the new Strecker Museum building and will be named The Ottys and Ruth Sanders Resource/Research Center" (Lintz, pers. comm.). Likewise, Ottys' cousins, Elouise and Henry Rieff of Cotton Center, Texas, gave me much information, were the chief sources of comfort in Ottys' later years, and served as executors of his estate. (Ottys' only other relatives are brothers-in-law Allen Maxwell of Dallas and Richard Maxwell of Knoxville, Tennessee, and a nephew, from his sister, in Houston. He was not close to any of them except Allen, whom he enjoyed and saw perhaps once a month. His sister-in-law, Agnes, died in June, 1992.) Dr. Chris T. McAllister of the V. A. Medical Center in Dallas kindly provided newspaper accounts. To all I am much indebted.

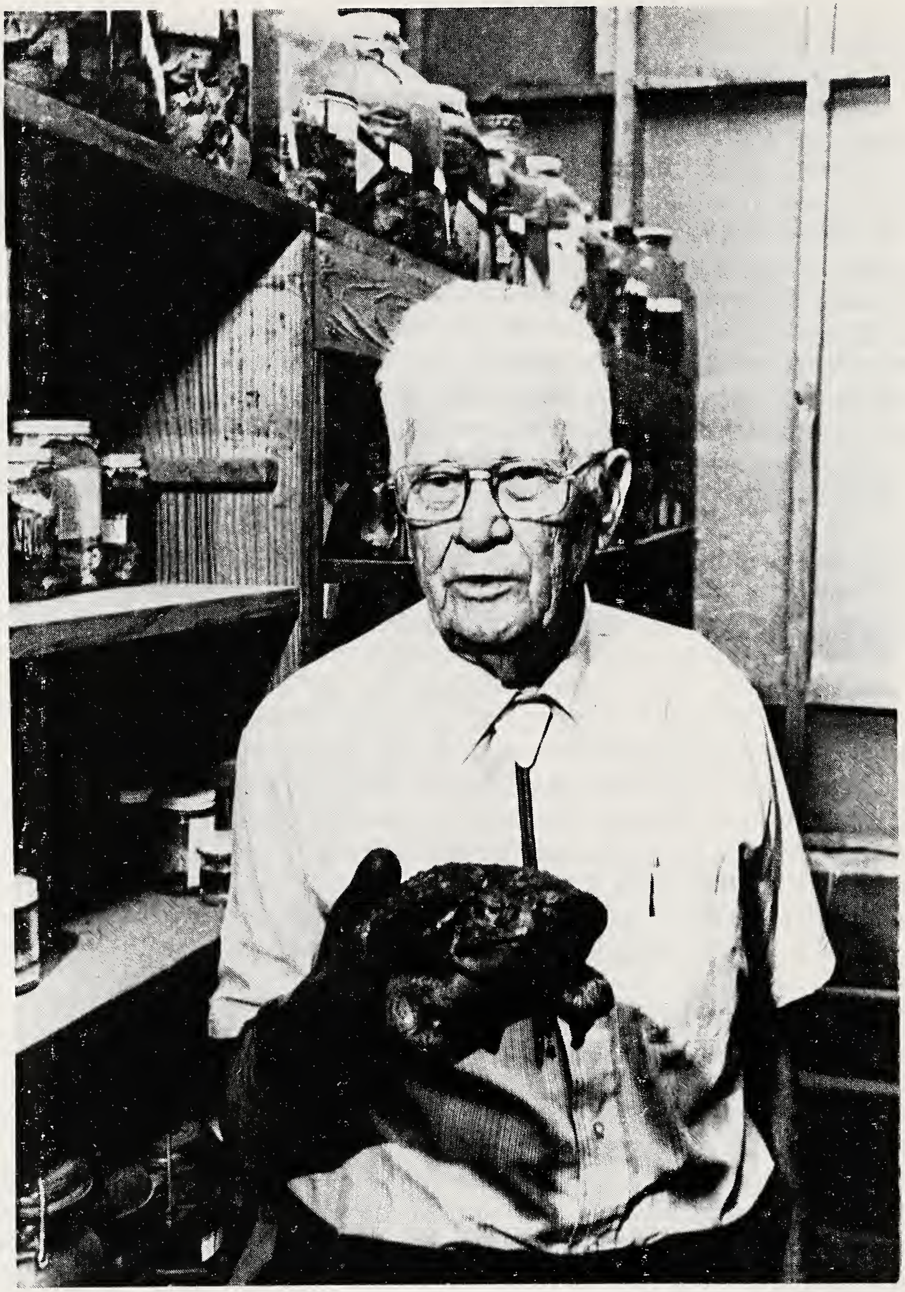

Fig. 1. Ottys Sanders in 1983, when he was 80 years old, wearing an H. M. Smith bola tie and holding an example, *Bufo marinus*, of his favorite research specialty. Taken in a storage room of the Strecker Museum, Baylor University, where the bulk of his herpetological collections and archives are now filed. Photo courtesy of the Strecker Museum.

Publications

Ottys Sanders was a surprisingly prolific writer considering the totality of his scientific, business and popular (poetic) products. His 48 scientific publications and manuscripts that we have been able to find are listed in the following bibliography, but it is likely that more exist. The pages of Bio-Log, the briefly published (vol. 1, nos. 1-7, 1931; vol. 2, nos. 1-4, 1932; vol. 3, nos. 1-2, 1933) in-house journal (modelled presumably after similar journals of other biological supply houses, e.g. Turtox News of the General Biological Supply House of Chicago, where he worked for a time) of his Southwestern Biological Supply Company, contained 19 original contributions (some signed "O. S.", others not) listed in the following bibliography. The whole journal, except where indicated otherwise, was of course written by him, but advertising material and descriptions of items for sale have not been included in the following list. The journal is somewhat of a mystery, even as Ottys was; it is on file in no library canvassed by The Union List of Serials. It no doubt consisted of more issues than are here indicated, gleaned from Ottys' archives in the Strecker Museum, to which I am indebted for those listed. Much additional writing, not here counted, was involved with the catalogs and fliers frequently issued in the interest of his business.

Ottys was also a dedicated poet throughout his mature life, although, as stated in the introduction to his only book of poetry ("Interlude and Other Poems", 1988, by "Ottys and Ruth Sanders", Austin, Texas, Nortex Press, vii+96 pp., $14.95), poetical productivity lapsed between the '20's and the 80's because of business and scientific pressures. He had numerous poems published in at least seven different journals in the '20's, all reproduced in his book, along with many others not previously published. That his poetry was well received by eminent critics is evident from the two first-place and one second-place awards he won in 1923 and 1924. In recent years, as his health declined and he found it difficult to get around, he spent an increasing amount of time with poetic composition, publishing his 1988 book and culminating with "The Sleeping Cat and Other Poems," a book manuscript by himself alone that is to be published at his request through the kind efforts of Elouise Rieff. We have made no attempt here to summarize his poetic writings; his book is the best source available, and covers his wife's writings, also of award-winning caliber, as well as his own.

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—*Hobart M. Smith*, Department of EPO Biology, University of Colorado, Boulder, Colorado 80309-0234.

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A NEW *LEPTOPHIS* (SERPENTES:COLUBRIDAE) FROM SIERRA NEVADA DE SANTA MARTA, COLOMBIA

Amanda Bernal-Carlo and Janis A. Roze

A new species of colubrid snake, *Leptophis santamarensis* is described from the Sierra Nevada de Santa Marta, and a key to distinguish the species of *Leptophis* from the region is given.

Resúmen

Se describe una nueva especie de serpiente, *Leptophis santamartensis* de Sierra Nevada de Santa Marta, Colombia, y se ofrece una clave para distinguir las especies de *Leptophis* de la región.

A recent survey of the herpetofauna of the Sierra Nevada de Santa Marta, Colombia [Bernal-Carlo, 1991] revealed an undescribed species of snake, genus *Leptophis* that is described herewith.

Leptophis santamartensis new species

Holotype: IND 3241, adult male from Ciudad Perdida, Sierra Nevada de Santa Marta, Departamento de Magdalena, Colombia, 1100 m, collected by R. Lleras and M. Velázquez.

Paratype: IND 3240, an adult female, the same data and collector as the holotype.

Diagnosis: This species differs from other species of *Leptophis* in having an uniformly gray [green] coloration above, with a light lateral stripe on second and third dorsal that reaches to the anus, and a postorbital black stripe that begins on the second supralabial and covers 10 to 12 dorsals. It has 152 to 157 ventrals and 141 to 150 subcaudals.

Description of holotype: The rostral is broader than high, visible from above. The internasals shorter than the prefrontals. The prefrontals broader than long, prominent and in contact with the second and third upper labials; no loreal. The frontal is 1.75 times longer than its greatest width and triangular in shape. Supraocular larger than the prefrontals, narrower anteriorly. Preocular slightly visible from above; two postoculars, upper larger than the lower; 1+2 temporals. Parietals are 1.2 times longer than the frontal; 8[4,5] supralabials, 10 infralabials, the first five in contact with the first pair of chin shields. There are 4 preventrals, 152 ventrals and 141 divided subcaudals. Dorsals in 15-15-11 rows, keeled, except the first two rows. Anal is divided. Dorsum uniformly light gray. The venter and the first two dorsal rows are white, but around the 40th ventral, the first dorsal row and the ventrals become grayish, while the second and the third dorsal rows are lighter forming an inconspicuous lateral stripe that runs to the anal region. Top of the head is grayish, lighter than the dorsum. The upper labials and the rostral are white. The head below ad the anterior part of the venter are immaculate. A black, narrow stripe runs from the upper border of the second upper labial, is interrupted by the orbit, but extends backwards covering the lower postocular, the temporals and 10 dorsals. The last two thirds of the venter are grayish blue as the dorsum. The total length of the holotype is 764 mm, 292 mm of which comprise the tail.

Description of paratype: In most features, the paratype is similar to the holotype, but with the following differences: the black postocular stripe extends over 12 dorsals; the frontal is 1.46 times longer than its greatest width. There are 3 preventrals, 157 ventrals and 150 subcaudals. The total length is 630 mm, 243 mm of which correspond to the tail length.

Notes: The new species is found in the cloud forest on the northern slopes of the Santa Marta mountains. It has precipitation of about 3500-4500 mm/yr. Most rain occurs in the months of May-October and the persistent trade winds on the northern and western slopes produce persistent mist and rain, characteristic of cloud forests. Dominant trees, more than 35 m tall, are *Dictyocaron schultzii*, *Ossaea quinquenervia*, *Chrysophyllum auratum*, and *Ficus apollinaris*. *Cecropia* sp. is also abundant.

Leptophis ahaetulla occidentalis [Günther] is widely distributed from Nicaragua to western Venezuela and to Ecuador. While it has been reported from altitudes up to 2400 m in the Central Andes of Colombia [Oliver, 1948], in Santa Marta it has only been reported from the northwestern xerophytic dry lowlands, below [Griffin, 1916; Ruthven, 1922; Amaral, 1928].

The two species of *Leptophis* known from the Sierra Nevada de Santa Marta can be distinguished as follows:

1. Males with 163-177, and females with 166-181 ventrals ....

.... *L. ahaetulla occidentalis*

2. Males with about 152 and females with about 157 ventrals .... *L. santamartensis n. sp.*

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We thank Dr. J. Hernández, José Vicente Rodríguez and José Vicente Rueda from the Instituto de Recursos Naturales Renovables y del Ambiente [IND] collection, Bogotá, Colombia for lending us the snakes and lizards of the Sierra Nevada de Santa Marta, and to Juan Mayr of Fundación pro Sierra Nevada de Santa Marta, Bogotá for facilitating the study of the Sierra.

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NOTES:

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The third Wednesday of each month, 8:15 p.m. at the Natural History Society of Maryland (except May—August, third Saturday of each month, 8:00 a.m.). The Department of Herpetology meets informally on all other Wednesday evenings at the NHSM at 8:00 p.m.

THE IMPACTS OF STORMWATER DISCHARGES ON AN EMERGENT BOG COMMUNITY FEATURING A POPULATION OF THE BOG TURTLES (*CLEMMYS MUHLENBERGI*) IN GLOUCESTER COUNTY, NEW JERSEY

Laurance S. Torok

Introduction

The direct impacts of stormwater on flora, fauna, and vegetational communities have not been broadly studied. Several researchers have analyzed changes to vegetational communities in urbanizing areas which have resulted, at least in part, from stormwater related impacts (Conner et al. 1981; Ehrenfeld 1983; Morgan and Philipp 1986; Stockdale 1986). Studies into the impacts on faunal species have largely concentrated on invertebrates (Williamson et al 1986; Roos and Wunk 1987) and fish communities (Reash and Berra 1987). All of these efforts focused on regional or cumulative impacts of stormwater and did not demonstrate a direct cause and affect relationship between stormwater discharges and habitat changes.

In this discussion, I will describe the vegetational community alterations that have resulted from direct stormwater discharges from an outfall. These alterations are of additional concern because the emergent wetland impacted also provided habitat to a population of bog turtles (*Clemmys muhlenbergi*), a species of concern at the state (endangered in New Jersey) and national (candidate species (C2), Appendix I of CITES) levels. Recommendations as to how these impacts may have been avoided is also presented.

Study Area

The study area was a 19 ha. (48 ac.) tract of land in Harrison Township, Gloucester County, New Jersey. The site consisted predominantly of successional farm field with a small, intermittent stream corridor running along the border featuring scrub-scrub, emergent, and hardwood forest wetlands. County soil mapping characterizes the wetland areas as alluvial soils (USDA 1962). At the time of this study, the emergent wetland supporting the bog turtle colony covered approximately 0.4 ha. (1 ac.) within a stream corridor wetland complex.

Background

Historically, the subject property had been used as a cattle pasture. This use helped to retard succession of the bog turtle's emergent wetland habitat. Active use of the site as pasture had ceased for several years prior to development, resulting in a gradual reduction in the amount of emergent habitat present. The colony had been known to local herpetologists since the early-1960's and turtles were still present in the spring of 1987 (C. Oldham pers. comm.).

In the fall of 1987, the New Jersey Department of Environmental Protection and Energy (DEPE) was notified that a wetland supporting the state endangered bog turtle was in imminent peril of destruction through construction of a housing development. A review of DEPE files indicated that the subject development had received all appropriate state approvals, including a permit to discharge stormwater from an outfall directly into the turtle's wetland habitat. Subsequent negotiations with the developer resulted in the redesign of the outfall to include a 19.82 m. (75 ft.) rip-rap channel between the wetlands and the headwall. In order to improve water quality, the rip-rap channel was to be resodded after construction of the subdivision was completed.

Since the fall of 1987, the subject wetland was visited by DEPE staff annually to evaluate the effectiveness of the redesign in preserving the wetland habitat. Changes in the vegetational community and structural characteristics of the wetland were noted during the period of September 1987 to October 1991.

Results

Baseline characteristics of the subject wetland prior to completion of the housing complex were established using descriptions and photographs found in the DEPE's permit files and the conditions observed and photographs taken during a September 1987 site inspection. As shown in Figure One, the wetland complex can be described as containing three distinct vegetational communities. Wetland community A is upstream of the outfall, wetland Community B is immediately adjacent to the point where the discharge entered the wetland complex, and Community C is downstream of Community B.

Community A was characterized by a successional red maple (*Acer rubrum*) closed canopied wetland forest. Dominant understory species consisted of sedges (*Carex spp*), sphagnum (*Sphagnum* spp.), sensitive fern (*Onoclea sensibilis*), marsh fern (*Thelypteris simulata*), deer tongue (*Dichanthelium clandestinum*), tear-thumb (*Polygonum* spp.) and jewelweed (*Impatiens* spp.). Wetland hydrology was characterized as saturation at the surface in the wetlands and adjacent intermittent stream corridor. Wetland community B was largely dominated by branching burweed (*Sparganium androcladum*), which accounted for 70-80% of the ground cover. Other vegetation present in this complex included a mixture of sedges, rushes (*Juncus* spp.), spikerushes (*Eleocharis* spp.), grasses and annuals occurring along the edges. Wetlands hydrology was characterized by surface inundation to a depth of approximate 2.5 cm (1 in.) with the development of a small stream channel at the intersection with wetland community C. Wetland community C consisted of a stream corridor and adjacent scrub-scrub wetlands. The stream channel was approximately 18-60 cm. (12-24 in.) across, with water depths of 2.5-7.5 cm. (1-3 in.), and copious ferric oxide deposits. Various ground water seepages drained into the main channel from the adjacent wetlands. Dominant shrub vegetation consisted of speckled alder (*Alnus regosa*), arrowwood (*Viburnum dentatum*) and red maple. Dominant ground cover species were sedges, grasses, and ferns.

By October 1991, four years after the construction of the outfall structure and the three years after the re-sodding of the rip-rap channel, significant changes had occurred in the wetland complex. The wetland communities described below correspond to those shown in Figure 2.

Little change had occurred to Community A other than the expected growth of the vegetation. The community continued to be dominated by red maple with an understory of sedges, ferns, tear-thumb, deer tongue, and jewelweed. Wetland hydrology had also remained much the same. Unlike Community A, significant changes had occurred to the vegetational community and the hydrology of wetland Community B. Vegetative species now present in a shrub-scrub (35%)/emergent (65%) community included black willow (*Salix nigra*), speckled alder, jewelweed, rice cut-grass (*Leersia* *oryzoides*), soft rush (*Juncus effusus*), and swamp milkweed (*Asclepias incarnata*). Branching burweed, which covered 70-80% of this community prior to the development, now occurred over less than 5% of the area.

Changes to the hydrologic regime of the wetland community B were also substantial. As a result of storm surges from the outfall, an erosional channel had been cut through the wetland. This channel varied in width from 15-72 cm. (6-29 in); in depth from 22.5-42.5 cm. (9-17 in.), and with water depths of 10-12.5 cm. (4-5 in.) in ponded cuts along the channel. In addition, storm surge velocities were substantial enough to undercut some areas, create multiple channels in others, and deposit trash (e.g. tire tube, cans, bottles) in the wetland.

Wetland Community C also exhibited some major modifications. While the species composition is essentially the same, sedges, which were initially one of the dominant ground cover species (approx. 60%) along the stream corridor, are now far less prevalent (<10%). Skunk cabbage (*Symplocarpus foetidus*), which was sparse (<10%) in 1987, is now the dominant understory species accounting for >80% of the ground cover. Reductions in the percentage of grasses and ferns have also occurred. Hydrologically, the stream corridor in Community C had widened significantly to 87.5+ cm. (35+ in.) and the channel cut to 37 cm. (15 in.). Several of the groundwater seeps occurring adjacent to the stream had disappeared and the amount of iron oxide deposits in the stream corridor is also significantly reduced.

Discussion

Bog turtles are associated with undisturbed bogs, swamps, and seepage areas which commonly feature an open canopy (Carr 1952; Barton and Price 1955; Ernst and Barbour 1972; Zappalorti et al. 1979). Seep bogs may also be characterized by rust-colored iron-oxide deposits (Arndt 1977). In an analysis of over 200 bog turtle colony sites in Maryland, Chase et al. (1989) suggested a correlation between the following site characteristics and higher turtle densities:

a. colony location in a circular basin;

b. presence of spring-fed pockets of shallow water;

c. a bottom substrate of soft mud or rock;

d. dominant vegetation of sedges and grasses; and

e. interspersion wet and dry pockets.

Prior to the construction of the stormwater outfall, the subject wetland habitat featured all of these characteristics. Within four years, the stormwater discharged through the headwall had altered the physical and structural characteristics of the wetland complex. Principally, the discharged stormwater:

1. carved a channel through the wetland;
2. modified the site hydrology by removing the surface inundation in Community B and many of the spring-fed seeps in Community C which occurred prior to the outfall; and
3. altered the structure and species composition of the vegetation community by increasing the invasion of aggressive woody species and annuals which replace the sedges and rushes typical of bog turtle habitats.

As a result, the wetland no longer featured three of the five characteristics identified as typical of active bog turtle sites. Surveys conducted for bog turtles at the site in 1988 and 1989 did not reconfirm the presence of bog turtles and it was recommended that this location be dropped from the list of active sites (Zappalorti and Farrell 1989). The continued degradation of the habitat observed in 1990 and 1991 further supported this determination.

Could these impacts have been avoided? Based on my experience, it is likely that the extent of impacts to the wetland caused by the stormwater outfall would have been minimized if one or more of the following steps were taken. However, it should be noted that each suggestion features positive and negative aspects.

1. *Outfall design.* If stormwater is being directly discharged from an outfall or headwall into a wetland, the outfall should feature a rip-rap channel which reduces stormwater velocities below erosion standards for the site soils. Resodding, as was done in this case, is not recommended.

2. *Location of stormwater discharge.* Locating the stormwater discharge downstream of the bog turtle habitat may reduce many of the impacts to the wetland described above. However, such an action does not mitigate the potential modifications of the wetland hydrologic regime resulting from the alteration of existing run-off and seepage to groundwater

patterns. Given that it has been suggested that modifications to wetland hydrology have a major influence on the structure and species composition of freshwater wetland vegetation (Ehrenfeld and Schneider 1991, Horner et al no date); the witnessed invasion of aggressive woody species could still occur if the redirection of site run-off downstream affects the volume of groundwater and/or sheet flow from the uplands to the wetlands.

3. *Inclusion of a basin as part of the overall site stormwater management plan.* Use of a detention or recharge basin within the overall site stormwater management plan will assist in reducing pollutant and hydrologic impacts to the onsite wetlands. In this case, a detention basin would have reduced stormwater flows and velocities and retained suspended soil particles thereby reducing the sediment load to the rip-rap channel and wetland and retarding the formation of the erosion channel within the wetland. A recharge basin, if feasible, could further reduce impacts by allowing stormwater to enter the wetland through sub-surface flow. Drawbacks include the lack of maintenance of basins (Sediment and Stormwater Division 1986; Pensyl and Clement 1987) in general and the modification of the timing when run-off enters a wetland (Ku et al 1992), both of which may impact the long term stability of the wetland community. Further study is necessary to firmly establish which structures or combination of structures will best protect sensitive wetland habitats of this nature from stormwater discharges.

Finally, it must be noted, that these recommendations primarily address impacts of stormwater velocities and volume. The potential impacts of changes to water quality have not been fully addressed. It must also be stressed that the failure to disclose the location of the bog turtle colony to state officials, while noble, prevented effective implementation of regulatory protection standards and possible landuse decisions at the local or county level which could have preserved the habitat.

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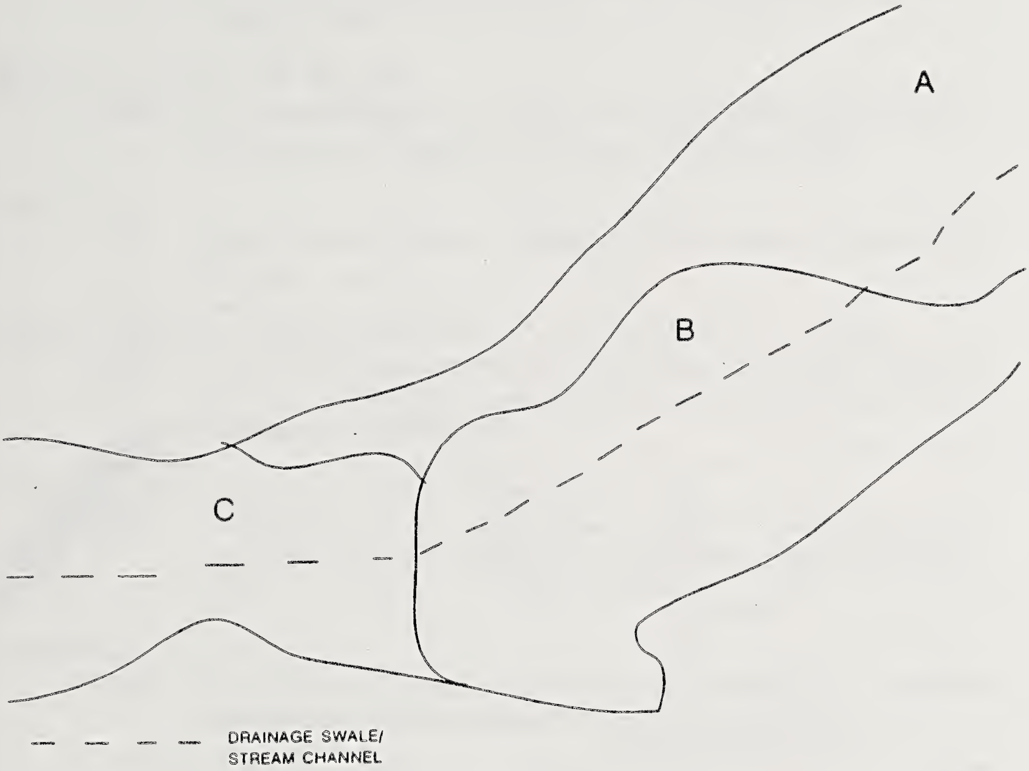

Fig. 1. Mill Race Farms 1987

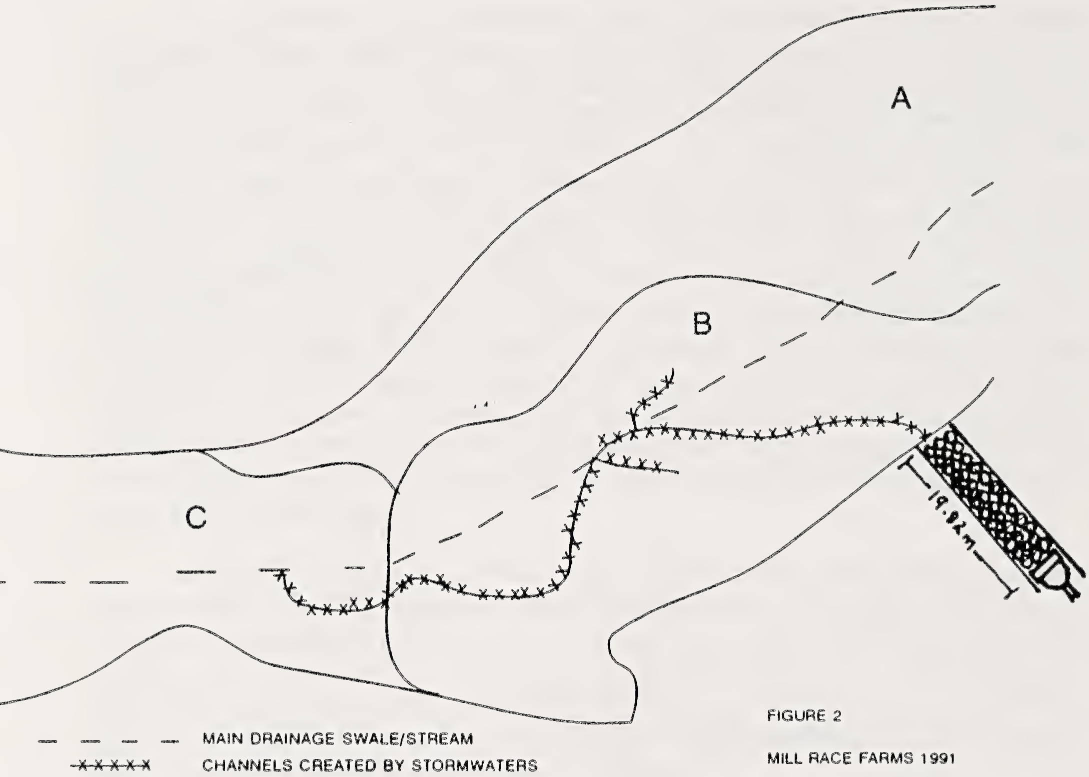
A
B
C
19.82m
— — — — MAIN DRAINAGE SWALE/STREAM
-X-X-X-X-X CHANNELS CREATED BY STORMWATERS
FIGURE 2
MILL RACE FARMS 1991

Fig. 2. Mill Race Farms 1991

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A COMPARISON OF FOOD HABITS OF A MONTANE AND A LOWLAND POPULATION OF *ANOLIS DISTICHUS* (LACERTILIA: POLYCHROTIDAE) FROM THE DOMINICAN REPUBLIC

Deborah J. Cullen and Robert Powell

Anolis distichus is widely distributed through the Bahamas, on Hispaniola, and in southern Florida (Schwartz and Henderson, 1991). Still, the species' dietary habits have been infrequently studied. Lister (1976) analyzed stomach contents of an Exuma Island population and showed that ants made up 59.3% of the items and 57.4% of the food volume. Leafhoppers, termites, beetles, hemipterans, dipterans, and "miscellaneous other arthropods" were also taken. Fitch et al. (1989) listed results of stomach content analysis in a population from La Romana, Dominican Republic. Ants were found in 82.6%, dipterans in 13.0%, and beetles in 4.3% of the stomachs examined. These data suggest that *A. distichus* specializes on ants, but will take other items when available. Moster et al. (1992) reported similar results from a study of *A. brevirostris*, a closely-related species, in altered habitat in Barahona, Dominican Republic. Pianka (1986) stated that specialization on social insects such as ants is "economically feasible because they normally occur in a clumped spatial distribution and hence constitute a concentrated food supply." Foraging behavior of *A. distichus* (Rand, 1962) and *A. brevirostris* (Moster et al., 1992) was concentrated on surfaces of tree trunks. In fact, trees on the trunks of which we often have observed *A. distichus* in La Romana, Puerto Plata, and Santo Domingo are frequently infested with ant trails. All of the previous studies, however, described diets only of lowland populations. As *A. distichus* also inhabits montane areas, we compared diets of two populations, one from a locality the elevation of which exceeds 1000 m, to test the hypothesis that elevation affects food habits.

We excised stomachs of 15 preserved specimens (BWMC 03780-4, 03789-90, 03793, 03811-6, 03818) from Santo Domingo (SD), Distrito Nacional (elevation near sea level), and of 15 specimens (BWMC 03827-9, 03831-4, 03840-1, 03843-8) from near Monteanada Nueva (MN), Barahona Province (elevation approximately 1100 m). To eliminate considerations of seasonal differences in diet, all specimens examined were collected during the month of March. Gastric contents were removed, identified, counted, and volumes determined using methods of Milstead (1957). Importance values (Powell et al., 1990) and Levins' measure of niche breadth (Krebs, 1989) were calculated. All means are presented ± 1 SD; for all statistical tests, $\alpha \leq 0.05$.

Mean snout-vent length (SVL) of individuals from Santo Domingo (38.5 - 48.4 mm, x = 43.3 ± 3.1 mm) was larger, but not significantly so, than that of individuals from Monteanada Nueva (33.9 - 49.4 mm, x = 41.0 ± 4.3 mm) (Mann-Whitney U, Z = -1.70, P = 0.09). As expected in a genus in which most species are known to be sexually dimorphic in size, mean SVL of males (SD: n = 8, 43.5 - 48.4 mm, x = 45.7 ± 1.7 mm; MN: n = 9, 33.9-49.4 mm, x = 42.2 ± 5.0 mm) was significantly greater than that of females (SD: n = 7, 38.5 - 41.9 mm, x = 40.5 ± 1.4 mm; MN: n = 6, 36.9-42.9 mm, x = 39.2 ± 2.1 mm) in both populations (Mann-Whitney U, Z = -3.01, P < 0.01).

Results of stomach content analysis are given in Table 1. In both populations ants dominated all categories considered, but the preponderance of ants was much higher in the lowland population. The diversity of items found in stomachs was greater in the montane population and the calculated niche breadth of this population (B = 5.50) was much greater than that of the population from Santo Domingo (B = 2.77). However, using importance values of all categories of contents to compare diets between these populations indicated that these differences were not statistically significant (Wilcoxen-Signed Rank, Z = 0.97, P = 0.33).

Niche breadth of males (B = 2.90) was higher than that of females (B = 2.24) in the lowland population, but the reverse was true in the montane population (males: B = 4.78; females: B = 6.00). Nor did the larger size of males impact the choice of food items, correlations between SVL and mean food item size were insignificant in both populations (SD: R = 0.49, P = 0.06; MN: R = 0.40, P = 0.14). Apparently, larger individuals were quite willing to consume small food items.

The characterization of *Anolis distichus* as an "ant specialist willing to take other prey when readily available" appears adequate when defining lowland populations of the species. Niche breadth of the Santo Domingo population was only marginally higher than those associated with all but the most extreme dietary specialists. However, the greater niche breadth of the montane population suggested a feeding mode that could be considered that of a dietary generalist / opportunist. This contrast may reflect differences in food availability as much as innate distinctions in feeding preferences or foraging modes, a suggestion supported by the lack of significant differences in total diets.

Table 1. Stomach contents of *Anolis distichus* from Santo Domingo (SD) and from near Monteanada Nueva (MN). Each entry contains four components. Entries in the first line are listed as a/b/c; in which a = total numbers of food items from all stomachs, b = frequencies of occurrence (numbers of individuals in which a particular type of item was found), c = volume of ingested items in cm^3. The figure given in the second line represents the importance value of that item in the diet (larger numbers indicate more important dietary components).

STOMACH CONTENTS	SD (N = 15)	MN (N = 15)
Arachnida (Araneae)	5 / 2 / 0.028 0.15	3 / 2/ 0.015 0.09
Coleoptera	5 / 3 / 0.008 0.12	15/ 11 / 0.040 0.37
Coleoptera (larvae)	—	2 / 2 / 0.028 0.11
Dictyoptera	5 / 5 / 0.030 0.23	2 / 2 / 0.020 0.09
Diptera	3 / 2 / 0.008 0.09	5 / 2 / 0.005 0.09
Diptera (larvae)	—	1 / 1 / 0.003 0.03
Hemiptera	—	2 / 2 / 0.005 0.07
Homoptera	3 / 2 / 0.008 0.09	3 / 3 / 0.008 0.09
Hymenoptera (Formicidae)	141 / 13 / 0.245 1.76	75 / 14 / 0.115 1.05
Isoptera (pupa)	1 / 1 / 0.001 0.03	—
Lepidoptera	2 / 1 / 0.023 0.09	4 / 4 / 0.028 0.16
Lepidoptera (larvae)	—	12 / 8 / 0.078 0.39
Orthoptera	3 / 3 / 0.030 0.17	3 / 3 / 0.038 0.28
Crustacea (Isopoda)	1 / 1 / 0.005 0.04	—
Unidentified arthropod parts	— / 3 / 0.008 0.08	— / 1 / 0.003 0.01
Lizard skin	—	— / 2 / 0.015 0.07
Reptilian eggshell	—	— / 1 / 0.005 0.01
Plant material	— / 2 / 0.008 0.05	— / 3 / 0.008 0.04
Grit	— / 1 / 0.003 0.03	— / 3 /0.008 0.04

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NATURAL HISTORY NOTES ON A POPULATION OF GRASS ANOLES, *ANOLIS OLSSONI* (SAURIA: POLYCHROTIDAE), FROM THE DOMINICAN REPUBLIC

Julia W. Smith, Robert Powell, John S. Parmerlee, Jr., Donald D. Smith, and Amy Lathrop

We examined aspects of natural history of an Hispaniolan grass anole, *Anolis olssoni*, from Barahona, Dominican Republic. Males were significantly larger than females and the sex ratio did not differ significantly from 1:1. Our observations indicated that these anoles occupy grassy habitats, are not territorial, and are thermal conformers and opportunistic feeders.

Anolis olssoni is a xerophilic anole endemic to the Hispaniolan North Island but which has invaded portions of the South Island (see Williams, 1961, or Schwartz, 1980, for a discussion of the importance of the North and South Islands in Hispaniolan biogeography). Little has been published about the natural history of *A. olssoni*. Schmidt (1921), Schwartz (1981), and Schwartz and Henderson (1991) provided descriptions of the species and made general references to habitat and habits. Populations of *A. olssoni* are typically found in *Acacia* and cactus deserts, lowland scrub, and montane pinewoods. Their habitus is distinctly elongate, enabling the lizards to conform to blades of grass or stems of herbaceous and small woody plants.

From 5 - 17 June 1991 we examined a local population of *Anolis olssoni extentus* in a mesic habitat (atypical for this species) near the Hotel Guarocuya, Barahona, Barahona Province, Dominican Republic. The city, situated at the southern edge of the Bahia de Neiba, has a mean annual temperature of 26.1° C and mean annual precipitation of 1047.1 mm (Salcedo et al., 1983). The study area of approximately 1850 m^2, located 46 m south of the hotel, was bordered on the south by mangrove forest, to the east by beach, to the north by a parking area, and to the west by private residences. Prominent vegetation in the area included grasses (*Cypress* sp., *Setaria setosa*, and *Digitario insularis*) and other non-arborescent vegetation (*Melanthera* sp., *Wedelia trilobata*, *Mikania micrantha*, *Achyranthus aspera*, *Lagascea mellis*, *Prosopis juliflora*, *Sida rhembifolia*, *Vigna luteola*, and *Parthenium hysterephorus*). Twelve trees, both broadleaf and palm, in the study area were not utilized by *A. olssoni*. Other lizards observed in the study area included *A. cybotes*, predominantly juveniles, commonly found on shrubs, although at night some individuals occupied essentially the same microhabitats as *A. olssoni*. *Anolis brevirostris* and *A. coelestinus* were restricted to trees and *Celestus costatus* was quite common in leaf litter. *Leiocephalus schreibersii*, *L. barahonensis*, and *Ameiva chrysolaema* occupied adjacent, more open areas and were not encountered in the study site.

Methods

Lizards were collected by hand or noose. Exact time of capture, location, and information concerning the nature and height of the perch were recorded for each animal. Cloacal, substrate, and air temperatures at 2 cm and 1 m were taken with a quick-reading thermometer (Miller and Weber, Inc., Queens, New York). Animals were measured, weighed, sexed, permanently marked by toe clipping, and temporarily marked with paint to allow identification of individuals without resorting to recaptures. In females, the presence of eggs and/or large ovarian follicles was determined by palpation and served as evidence of adult status. The size at which males reached maturity was determined later by the presence of sperm in the epididymes of specimens used for stomach content analysis. Individuals were released at the exact location from which they were captured. The Schnabel method and Lincoln-Peterson index were used to estimate population size, and home range sizes were calculated using the convex polygon method of Rose (1982).

Stomachs of 16 preserved *Anolis olssoni*, previously taken from the general area of the study site in March 1986 (n = 4), August 1987 (n = 9), and May 1989 (n = 3), and 12 *A. olssoni* taken from an adjacent population during the course of this study were excised and the contents examined. Ingested arthropods were identified to order (rarely to family), counted, and subjected to volumetric analysis using techniques of Milstead (1957). Importance values of each type of food item were calculated according to Powell et al. (1990). A sweep with an aerial net through the vegetation at the study site was performed on the last day of the study to sample the arthropod population (Knudson, 1966). Collected materials were preserved and transported to the laboratory for identification. All means are presented plus or minus one standard deviation, for all statistical tests, $\alpha \leq 0.05$.

Results and Discussion

A total of 112 animals (86 adults and 26 juveniles) was captured and marked within the study site during the study period. All age classes and both sexes were observed utilizing the same microhabitats. The actual population size and density were estimated as 120 and 650/ha and 112 ± 7.4 and 608/ha using the Schnabel method and Lincoln-Peterson index, respectively. Estimates might have been affected by migration as the population was not completely isolated. Increased mortality as a result of markings could not be ruled out, although animals seemed unaffected by capture and painting. Individuals were often observed repeatedly and most remained in the vicinity of their original sites of capture upon release.

The density estimates reported here may be unusually high as resource abundance may have been affected by the atypically (for *Anolis olssoni*) mesic conditions. In regions more commonly associated with this species, xeric areas in the Llanos de Azua and the Valle de Neiba in which *A. olssoni* were observed on this and previous trips, individuals were encountered far less frequently.

The smallest female with a large ovarian follicle had a snout-vent length (SVL) of 39 mm. Snout-vent lengths of adult males (SVL > 39 mm, n = 48, 39 - 53 mm, $\bar{x}$ = 44.4 ± 2.6 mm) were significantly greater than those of adult females (n = 38, 39 - 47 mm, $\bar{x}$ = 41.7 ± 1.7 mm) (Mann-Whitney U, Z = -5.33, P = 0.0001). The sex ratio (M:F) of adults from the study site population (48:38) did not differ significantly from an expected 1:1 ratio (DF = 1, x^2 = 1.16, P = 0.28). Thirteen of 38 females contained large ovarian follicles and/or ova. Two individuals contained 1 follicle; eight had 1 egg; two contained 2 eggs; and one had 1 egg and 1 follicle.

Few potential predators were seen in and around the area. Two adult *Antillophis parvifrons*, a common colubrid whose diet consists predominantly of anoles (Henderson et al., 1987), contained a *Celestes costatus* and a *Sphaerodactylus difficilis*. We have no reason to assume that these snakes do not consume *Anolis olssoni*, given the opportunity.

Estimated female home range sizes (n = 16, 0.7-303.3 m^2, $\bar{x}$= 28.3 ± 74.6 m^2) were not significantly larger than those of males (n = 10, 0.4-94.2 m^2, $\bar{x}$ = 25.4 ± 28.5 m^2) (Mann-Whitney U, Z = -1.32, P = 0.19). Home range sizes and SVL were not significantly correlated (DF = 1, R = 0.111, P = 0.64; DF = 1, R = -0.306, P = 0.25; DF = 1, R = -0.07, P = 0.69 for adult males, adult females, and all adults, respectively). Estimates of adult female home range sizes did not increase with numbers of observations (n = 16, range 3-15, $\bar{x}$ = 6.4 ± 3.2) (DF = 15, F = 0.01, P = 0.92). However, a minimum of six observations was necessary before male home range estimates (n = 10, range 6-19, $\bar{x}$ = 9.3 ± 4.0) failed to increase significantly with additional observations (DF = 9, F = 3.34, P = 0.11).

Thirteen of 20 male home ranges overlapped with those of at least one other male; 14 with those of at least one female. Fifteen of 17 female home ranges overlapped with those of at least one other female; 13 with those of at least one male. The relatively high frequency of overlapping ranges and the dearth of observations of agonistic male-male interactions gave the impression that *Anolis olssoni* is not territorial. Peters and Schubert (1968) commented on the remarkable absence of territoriality in Cuban grass anoles.

The mean distances traveled between points of reobservation were determined in order to gain an understanding of how far individuals moved during 24-h periods (Barbour and Rose, 1967). Mean distances traveled by adult females between points of reobservation ranged from 1.1 - 18.2 m (n = 17, $\bar{x}$ = 4.3 ± 3.9 m) did not differ significantly from those of adult males (0.7 - 11.0 m, n = 20, $\bar{x}$ = 3.7 ± 2.5 m) (Mann-Whitney U, Z = -0.44, P = 0.66).

The height at which animals were found ranged from 0.2 - 1.5 m (n = 272, $\bar{x}$ = 0.60 ± 0.30 m). Leaf blades or stems of grasses constituted 48%, stems of non-arborescent woody or herbaceous plants 21%, topside of broad leaves 20%, and grass peduncles 11% of recorded perches. No animals were observed on the ground or on larger trees. When approached, *Anolis olssoni* typically escaped by descending into thick ground-level vegetation, a behavior previously described by Schwartz (1981).

Temperature data and observations were evaluated separately for daytime (0500 - 1800 h) and evening (1800 - 2300 h) periods. During the day animals generally assumed a horizontally sprawled posture, often resting one or two limbs on leaves or blades of grass with the other limbs or the tail extended onto adjacent leaves or stems. Lizards were found at lower heights during the day as they moved about in the dense vegetation.

Lizards were first observed moving at 0500 - 0545 h and were active throughout the day. Daytime cloacal temperatures of 26 different individuals ranged from 29.8 - 34.0° C ($\bar{x}$ = 32.3 ± 1.3° C) and substrate temperatures from 28.5 - 34.5° C ($\bar{x}$ = 30.5 ± 1.3° C). The mean difference between daytime cloacal and substrate temperatures was 1.6 ± 1.0° C. The animals were found in full shade 56%, diffuse sunlight 38%, and full sunlight 6% of the time.

Lizards were inactive at night, and observed postures were quite different. Animals were found conformed to the substrate, typically a blade of grass or the stem of a plant, with heads facing up. Evening cloacal temperatures ranged from 28.0 - 32.5° C (n = 62, $\bar{x}$ = 29.6 ± 1.0° C) and substrate temperatures from 25.0 - 31.0° C (n = 58, $\bar{x}$ = 27.5 ± 1.2° C). The mean difference between evening cloacal and substrate temperatures was 2.1 ± 1.2° C (n = 58). The slight increase in temperature differences during evening over daylight hours was not significant (Mann-Whitney U, Z = -1.81, P = 0.07).

Lizards in an open habitat or low-cost environment where the associated costs of thermoregulation are low relative to the derived benefits would be expected to thermoregulate carefully (Huey and Slatkin, 1976). In this population, individuals were not observed basking or actively thermoregulating in any obvious manner, but usually avoided full sunlight even in the early morning hours when air temperatures were relatively cool. The cost of raising body temperature may be high in a continuous grass-covered habitat. Grasses and shrubs cast long shadows when the sun is at low angles, resulting in few available fully exposed basking sites, with the exception of the upper tips of the plants where lizards might be exposed to increased predation (Huey et al., 1977). Because of their small size *Anolis olssoni* probably have a high rate of radiant heating and cooling, making it selectively advantageous for these lizards to avoid potential stress and adopt a strategy of thermal passivity (Huey and Slatkin, 1976).

Stomach-content analysis (Table 1) revealed that leaf hoppers (Homoptera), ants (Hymenoptera, Formicidae), and grasshoppers (Orthoptera) were present in the most stomachs and in the largest numbers. Lepidoptera (larvae), Homoptera, and Orthoptera were found to make up the bulk of the diet by volume. The presence of nine other food categories suggests that *Anolis olssoni* is an opportunistic feeder. A positive correlation existed between SVL and food item size (DF = 1, R = 0.19, P =0.04). Importance values of food items did not differ significantly between males and females (DF = 11, t = 0.331, P = 0.75).

Results from the sweep samples generally supported the hypothesis that *Anolis olssoni* is an opportunistic feeder. Homoptera, found most frequently in stomachs, were also found in the greatest numbers in the sweep sample. Similarly, Orthoptera and Coleoptera were found in abundance in both the contents from the sweep and in the examined stomachs. Only two ants (Hymenoptera, Formicidae) were found in the contents of the sweep but were second in abundance in the stomachs examined. *Anolis olssoni* might actively search for ants or, more likely, this difference is the result of sampling error, as ants may be hard to dislodge from vegetation during a sweep or more commonly found near ground level where sweeping is ineffective. Diptera were found in large numbers in the sweep, but were absent from stomachs, suggesting that they are unpalatable or, more likely, difficult to catch; although *A. olsoni* is quite adept at prey capture and can take winged insects (one individual was observed catching a moth in flight).

Only five observations of male:female display behavior were recorded; all varied considerably in duration and content, even by a single individual. Males began displaying within 7.5 cm - 1.8 m of the female, then actively pursued her in each instance. Frequent pauses of varying duration interrupted displays and/or pursuits. Displays included head bobs and push ups, using the forelimbs to raise and lower the anterior half of the body, and four different actions involving the dewlap: (1) a full dewlap — a fully extended gular fan, (2) a half dewlap — a partial extension of the gular fan, (3) a double dewlap — two dewlaps performed consecutively without a pause, and (4) a long dewlap — a prolonged extension of the gular fan (up to 3 minutes).

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Table 1. Summary of food habits of *Anolis olssoni* (n = 28) from Barahona, República Dominicana: A. total numbers of food items, B. volumes of types of stomach contents (in cm^3), C. frequencies of occurrence (numbers of individuals in which a particular type of item was found).

STOMACH CONTENTS	A	B	C
Arachnida (Araneae)	4	0.028	4
Arachnida (other)	1	0.03	1
Coleoptera	9	0.060	4
Hemiptera	2	0.050	2
Homoptera	498	1.130	14
Hymenoptera (Formicidae)	27	0.060	10
Hymenoptera (other)	5	0.068	5
Lepidoptera	2	0.022	2
Lepidoptera (larvae)	2	2.007	2
Mecoptera	1	0.015	1
Odonata	1	0.050	1
Orthoptera	11	0.102	7
Unidentified arthropod parts	—	0.003	1
Plant material	—	0.003	1
Grit	—	0.005	3

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DELETION OF THE CORAL SNAKE *MICRURUS FULVIUS* FROM THE HERPETOFAUNAL CONCEPT OF MICHOACÁN, MEXICO

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Understanding of the geographic range of *Micrurus fulvius* (Linnaeus) was considerably extended (from Morelos, Roze, 1983: 326) and the species was added to the concept of the herpetofauna of Michoacán, Mexico, by the report, in the catalog of the herpetological collection (Flores Villela et al., 1991: 214-215) of the Museo de Zoología "Alfonso L. Herrera" of the Universidad Nacional Autónoma de México, of *M. fulvius fitzingeri* (Jan) from 3 km S Apatzingán.

Upon reexamination we find that the specimen, MZFC 2009, on which the report was based, had been misidentified, and that *M. f. fitzingeri* should therefore be deleted from the tentative list of the herpetofauna of Michoacán. It is, instead, an example of *M. l. laticollaris* (Peters), a subspecies already well known from the state (Roze, 1983: 328). A small (~412 mm total length, tail 145 mm) female, it has 211 ventrals, 36 subcaudals, 1+2 temporals and seven black-white-black-white-black triads on body, the first and last complete only on head and tail respectively. The snout is entirely black, and that color does not extend quite to the posterior tip of the frontal. In all these respects it conforms with the characteristic variation of *L. l. laticollaris* (Campbell and Lamar, 1989: 125).

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ISOZYME SURVEY OF TWO-LINED SALAMANDER (*EURYCEA BISLINEATA*) POPULATIONS IN MARYLAND AND VIRGINIA

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Previous studies of the two-lined salamander, *Eurycea bislineata*, suggested division of the species complex into geographical groups based on genetic differences, with demarcation between two particular groups across northern Virginia and southern Maryland. We examined 103 salamanders drawn from eight populations of *E. bislineata* within this region and determined allele frequencies at 16 loci using starch gel electrophoresis and histochemical staining techniques. We quantified relationships between populations based on genetic distances, and found no clear demarcation between the C and D groups of Jacobs (1987) in this region. We explain the differences in the conclusions of these two studies in terms of local genetic processes, notably random drift, obscuring patterns of genetic variation apparent at a large geographic scale of observation.

The two-lined salamander (*Eurycea bislineata*) species complex (family Plethodontidae) is widely distributed in stream and spring ecosystems throughout eastern North America (Conant, 1975; Mittleman, 1966). The systematic relationships among the various forms remains unclear (Jacobs, 1987). Geographic genetic variation within the species complex has been addressed using morphological (Mittleman, 1949; Sever, 1972) and electrophoretic (Guttman and Karlin, 1986; Jacobs, 1987) characters. Results of an isozyme-based survey of two-lined salamander populations collected from throughout the eastern United States (Jacobs, 1987) suggested that the species complex comprised three species with little geographical overlap. The putative species *Eurycea bislineata*, distributed throughout the northeastern United States and Canada, was tentatively subdivided into two geographically defined groups, C and D, with distributions provisionally demarcated through northern Virginia and southern Maryland (Figure 1). However, Jacobs (1987) examined allozyme variability at only four populations in this region, with one population being represented by a single individual. Against the background of this earlier work, the objective of our study was to examine allozyme variability of two-lined salamander populations in Maryland and northern Virginia.

Methods

Collections. Five to 30 individual salamanders were collected at eight localities in Maryland and Virginia (Table 1, Figure 1). Salamanders collected were identified as two-lined salamanders by reference to Smith (9178).

Salamanders were retrieved from the field live and held at 4° C for one week to clear ingested materials. Specimens were held briefly at -20°C until transported to the laboratory for longer-term storage at -60°C.

Electrophoretic methods. Animals were bisected longitudinally and homogenates prepared using one of the halves immediately before electrophoretic analyses. Electrophoretic methods followed Jacobs (1987). Allelic variation at 16 presumptive gene loci was observed using the methods of Selander *et al.* (1971). The loci screened were those found polymorphic in populations of *Eurycea bislineata* of the mid-Atlantic region (Jacobs, 1987).

Locus and allele nomenclature followed that of Jacobs (1987). When more than one locus was resolved on a gel, the locus which was most anodal was assigned the number 1. For polymorphic loci, alleles which migrated farthest from the origin were designated allele *a*.

Data analyses. Statistical analyses were executed through use of the program BIOSYS-1 (Swofford and Selander, 1981), release 1.7, intended for microcomputers (Swofford and Selander, 1989). We were unable to run analyses of our data in combination with Jacobs' (1987) data because of unclear correspondences of alleles at many loci. We were unable to establish contact with Jacobs to ask for salamander tissues for use as electrophoretic controls.

Results and Discussion

Intrapopulation variability. - Eight populations of two-lined salamanders were screened for allozyme variability within ten enzyme systems encoded at 16 putative isozyme loci (Appendix 1). Fifteen loci proved polymorphic (Table 2); at nine loci, frequencies of less common alleles exceeded 0.05 in at least half of the populations examined. Different alleles became fixed in different populations at 12 loci. Private alleles, i.e., allozymes observed in only one population, were found at eight loci.

Statistics summarizing genetic variability within the eight populations are presented in Table 3. Mean numbers of alleles per locus (grand mean, 1.49) ranged from 1.3 (Poverty Creek, VA) to 1.8 (Cunningham Falls, MD). Percentages of loci polymorphic (grand mean, 44.6) ranged from 25.0 (Poverty Creek, VA) to 68.8 (Cunningham Falls, MD). Mean direct-count heterozygosities were less than Hardy-Weinberg expectations (Nei, 1978) in all cases; the proportions of heterozygosities observed/expected (mean, 0.42) ranged from 0.19 (Poverty Creek, VA) to 0.64 (Sky Meadows, VA).

Because results of chi-square tests are suspect in cases when expected frequencies of some genotypic classes are low, exact significance probabilities were used to assess the significance of departures of allozyme genotype frequencies from Hardy-Weinberg expectations (Appendix 2). Across all populations collectively, 41 of 57 departures were significant, most the consequence of deficiencies in the frequencies of heterozygotes. Lower than expected frequencies of heterozygotes indicate violation of assumption(s) underlying the Hardy-Weinberg model; a likely explanation for this is the occurrence of matings among relatives within populations as small as those of two-lined salamanders in many of the habitats sampled.

Interpopulation variability.- Genetic differentiation of populations was assessed using F-statistics (Wright, 1965, 1978; Nei, 1977). F_{IT}, F_{IS}, and F_{ST} statistics were calculated for each individual allele, and grand means for each statistic were determined (Table 4). Because the loci screened were chosen as likely to be polymorphic rather than randomly drawn to represent the genome, the F-statistics presumably were subject to upward bias; however, data from all populations were affected to a similar degree. Mean F_{ST} was greater than mean F_{IS}, indicating a greater level of genetic differentiation among as opposed to within populations. The heterogeneity of allele frequencies among populations was tested using contingency chi-square statistics (Workman and Niswander, 1970). Significant test results were obtained at 15 loci (Table 5), indicating that interpopulation variability was significant.

Unbiased genetic distance (Nei, 1978) coefficients were calculated for each paired combination of populations (Table 6). Genetic distances among populations of *E. bislineata* were compared with reference to the distinction between the C and D groups proposed by Jacobs (1987). Populations 4, 5, 7, and 8 (this study) are located in the geographic region occupied by Jacobs' group C, while populations 1, 2, 3, and 6 are located in the geographic region occupied by Jacobs' group D. However, genetic distances among the eight populations surveyed suggest a poor fit of geographically defined populations within Jacob's geographically-based C and D groups. The two most closely related populations, 3 and 8, have a genetic distance of only 0.018 (Table 6), but they are located in groups D and C, respectively. The next closest relationship exists between populations 2 and 7, with a genetic distance of 0.037 (Table 6). These populations also fall into groups D and C, respectively.

We offer an explanation of the poor fit of the populations we surveyed into the C and D groups proposed by Jacobs (1987). Although the two-lined salamander is the most widely distributed plethodontid salamander in North America (Conant, 1975; Mittleman, 1966), its populations tend to be isolated, with little migration between them. If large geographic-scale natural selection was the major driving force in determining allele frequencies, isolated populations within the same geographic region would tend to have similar arrays of allele frequencies (Larson *et al.*, 1984). However, the allozyme frequency data in our study show much differentiation among gene pools of populations with modest geographical separation. Populations within the same geographic area were often found to be fixed for different alleles. For example, populations 4 and 7 were only 7.6 km apart, in closely associated drainages, but populations 4 was fixed for allele B at the 6PGDH-1 locus, while population 7 was fixed for allele A at that locus. The overall genetic distance of these two populations was 0.501 (Table 6). Random genetic drift, therefore, seems more important than geographic-scale selective effects or inter-population migration in determining allele frequencies for the two-lined salamander populations surveyed. Invocation of random genetic drift as an important driving force seems justifiable inasmuch as it would lead to independent changes in the arrays of allele frequencies among the respective isolated populations. Having examined two-lined salamander populations in a focused geographical area, we infer that genetic processes acting at a local scale tended to obscure the pattern of genetic variation apparent at a larger geographic scale of observation. We regard our results not necessarily as contradictory to Jacobs (1987), but more likely as complementary, showing that demarcation of two geographically defined forms of *E. bislineata* may be obscured by inter-form hybridization and/or genetic drift effects at the zone of contact. Examination of additional populations from a longer transect across the putative zone of contact can test the veracity of this explanation.

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Table 1. State, county, and specific location of each sample of *E. bislineata* collected. The specific location denotes the downstream boundary of the collection area, each area was approximately 50 m long.

Site Number	State:County	Specific Location
1	VA: Montgomery	(Pandapas Pond) - Poverty Creek, 250 m below Pandapas Pond.
2	MD:Prince George's	(Cosca Regional Park) - Clearwater Creek, 250 m from jct. with Butler Branch
3	VA:Fauquier	(Sky Meadow State Park) - Unnamed creek, jct. with Entrance Road
4	MD:Frederick	(Cunningham Falls State Park) - Little Hunting Creek, 250 m from jct. with Rt. 15
5	MD:Allegany	(Dans Mt. WMA) - Tom's Hollow Creek, 0.40 km from WMA boundary
6	VA:Shenandoah	Runion Creek tributary, 100 m from jct. with Rt. 610, 0.71 km from Rockingham County border
7	MD:Frederick	(Catoctin Mt. Park) - Owen's Creek, 10 m from jct. with Foxville-Deerfield Road
8	MD:Howard	(Patapsco Valley State Park) - Unnamed Creek, jct. with Landing Road, 0.40 km N of Norris Lane

Table 2. Polymorphic loci and the alleles observed.

Locus	Alleles Observed
General Protein - 1	A, B, C
General Protein - 2	A, B, C
General Protein - 3	A, B, C
Malic Enzyme - 1	A, B
Fumerase - 1	A, B, C
6-Phosphogluconate Dehydrogenase - 1	A, B
Phosphoglucomutase Dehydrogenase - 1	A, B
Phosphoglucose Isomerase - 1	A, B, C
Phosphogulcose Isomerase - 2	A, B
Phosphoglucose Isomerase - 3	A, B, C
Malic Dehydrogenase - 1	A, B
Isocitrate Dehydrogenase - 1	A, B, C
Glutamic Oxaloacetic Transaminase - 1	A, B, C
Peptidase - 1	A, B, C
Peptidase - 2	A, B, C, D

Table 3. Genetic variability statistics for 16 loci in eight populations of *E. bislineata*. Standard errors are denoted in parentheses.

Population	Mean Sample Size Per Locus	Mean No. of Alleles Per Locus	Percentage of Loci Polymorphic*	Mean Heterozygosity	
				Direct Count	HdyWbg Expected**
1	5.0 (0.0)	1.3 (0.1)	25.0	0.025 (0.017)	0.131 (0.059)
2	14.0 (0.0)	1.4 (0.1)	37.5	0.040 (0.036)	0.096 (0.040)
3	14.0 (0.0)	1.6 (0.1)	56.3	0.121 (0.059)	0.189 (0.052)
4	12.3 (0.80)	1.8 (0.2)	68.8	0.104 (0.064)	0.252 (0.057)
5	14.0 (0.0)	1.5 (0.2)	43.8	0.063 (0.063)	0.162 (0.059)
6	13.2 (0.8)	1.4 (0.1)	37.5	0.031 (0.016)	0.075 (0.034)
7	14.0 (0.0)	1.4 (0.1)	37.5	0.049 (0.045)	0.150 (0.053)
8	13.2 (0.8)	1.5 (0.1)	50.0	0.107 (0.064)	0.203 (0.057)

* A locus was considered polymorphic if more than one allele was detected.

** Unbiased estimate (see Nei 1978)

Table 4. Summary of F-Statistics at all loci screened for eight populations of *E. bislineata.*

Locus	F(IS)	F(IT)	F(ST)
PGM-1	-0.513	-0.347	0.110
GPI-1	1.000	1.000	0.899
GPI-2	1.000	1.000	0.608
GPI-3	1.000	1.000	0.866
MDH-1	1.000	1.000	0.063
IDH-1	1.000	1.000	0.742
AAT-1	0.951	0.984	0.685
PEP-1	0.447	0.855	0.737
PEP-2	0.761	0.855	0.394
ME -1	0.889	0.957	0.612
FUM-1	1.000	1.000	0.751
6PG-1		1.000	1.000
GP -1	0.820	0.933	0.625
GP -2	0.266	0.691	0.579
GP -3	0.722	0.869	0.530
MEAN	0.552	0.840	0.644

Table 5. Contingency of chi-square analysis at all loci screened for eight populations of *E. bislineata*.

Locus	Number of Alleles	Chi-Square	D.F.	P
PGM-1	2	24.101	7	0.001
GPI-1	3	197.662	14	<0.001
GPI-2	2	121.802	7	<0.001
GPI-3	3	150.778	14	<0.001
MDH-1	2	12.839	7	0.076
IDH-1	3	199.728	14	<0.001
AAT-1	3	230.317	14	<0.001
PEP-1	3	270.863	14	<0.001
PEP-2	4	183.002	21	<0.001
ME -1	2	104.882	7	<0.001
FUM-1	3	249.061	14	<0.001
6PG-1	2	184.000	7	<0.001
GP -1	3	165.882	14	<0.001
GP -2	3	248.574	14	<0.001
GP -3	3	160.783	14	<0.001
(TOTALS)		2504.272	182	<0.001

Table 6. Matrix of genetic distance coefficients for eight populations of *E. bislineata*. Below the diagonal represents Nei's (1978) unbiased genetic distance.

Population	1	2	3	4	5	6	7	8
1	—							
2	0.434	—						
3	0.437	0.602	—					
4	0.496	0.613	0.323	—				
5	0.723	0.569	0.323	0.443	—			
6	0.382	0.265	0.635	0.625	0.688	—		
7	0.457	0.037	0.490	0.501	0.442	0.304	—	
8	0.510	0.630	0.018	0.318	0.368	0.717	0.547	—

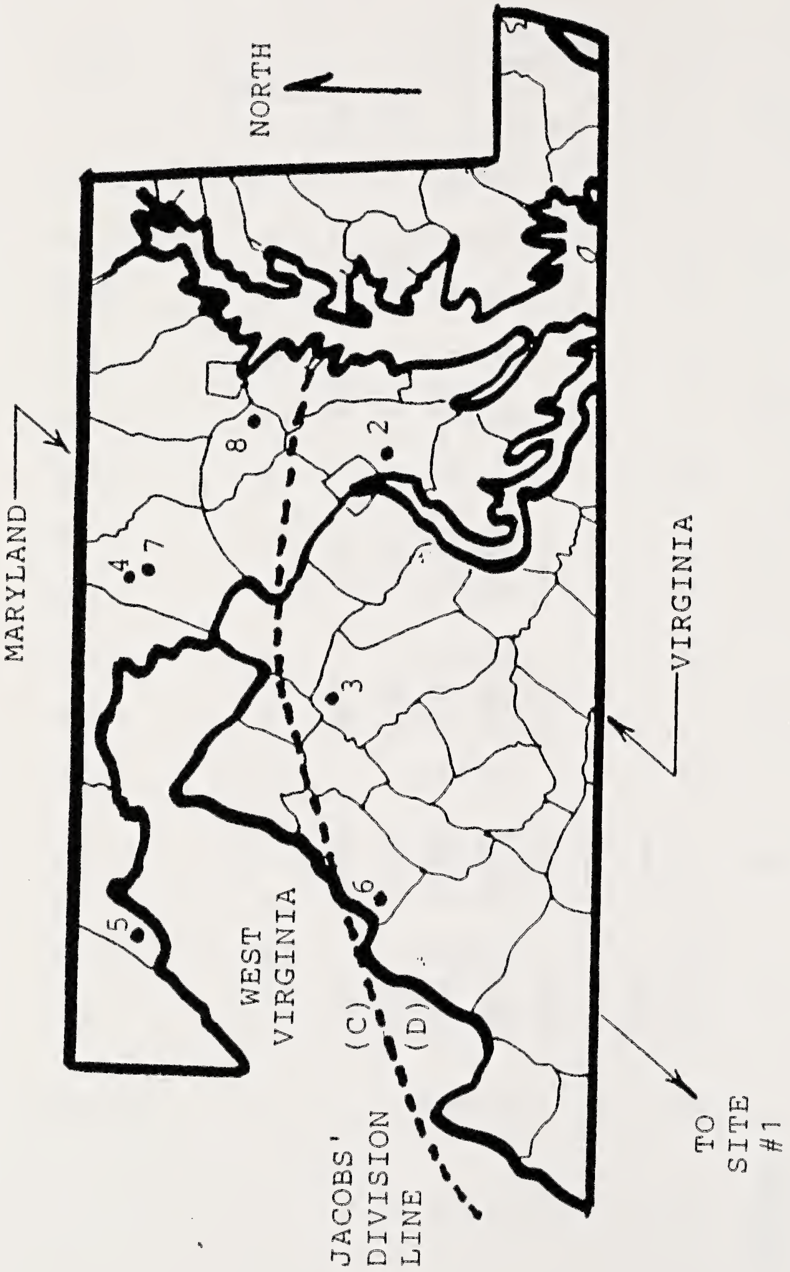

Fig. 1. Locations of collection sites of *E. bislineata* in Maryland and Virginia. The division line for Jacobs' C and D groups is indicated; group C lies north of the line, group D lies south of the line.

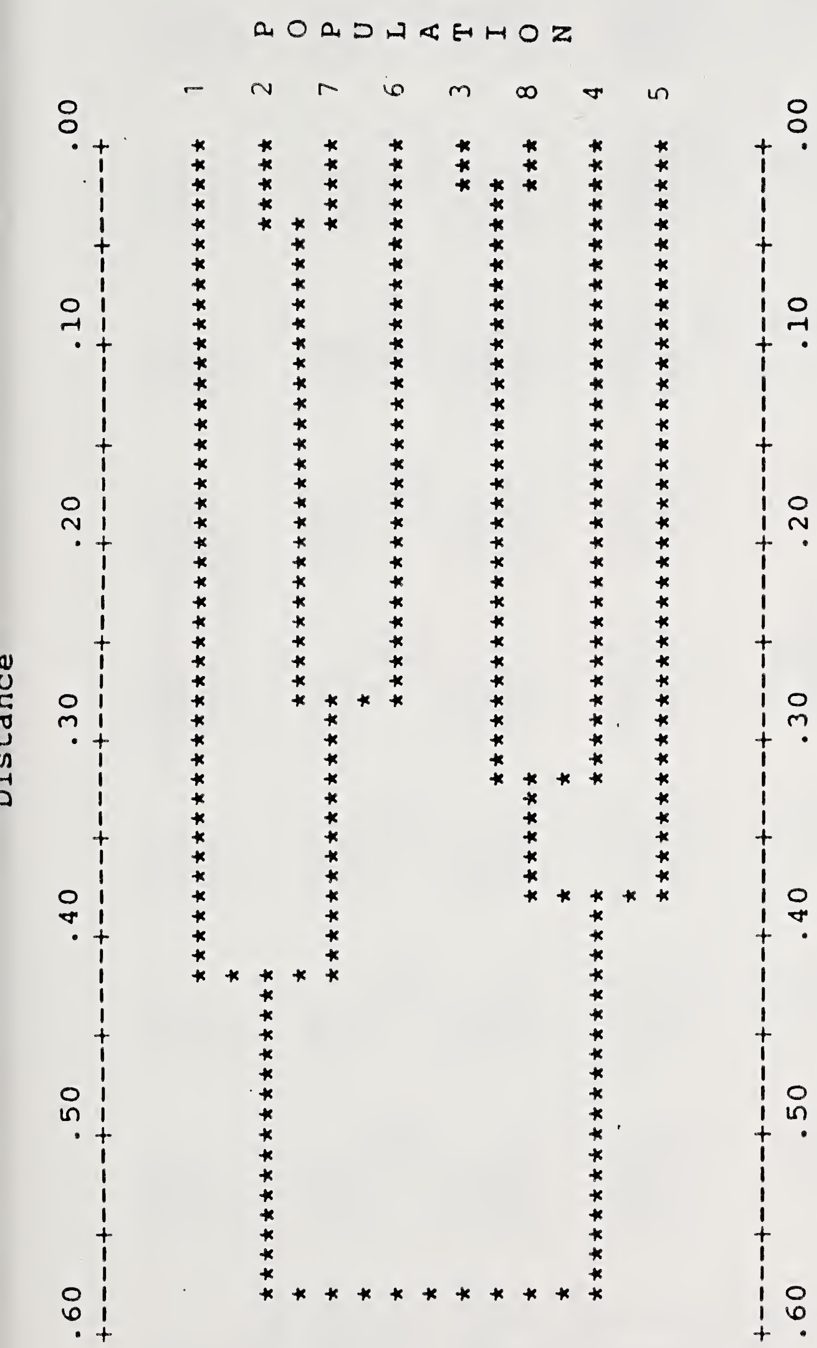

Fig. 2. Dendrogram expressing genetic relationships of eight populations of *E. bislineata* based on genetic distances.

APPENDIX 1

Allele frequencies for 16 loci of *E. bislineata* from eight populations. Population numbers correspond to locations described in Table 1.

	Population							
Locus	1	2	3	4	5	6	7	8
PGM-1								
(N)	5	14	14	14	14	14	14	14
A	0.300	0.286	0.393	0.500	0.500	0.000	0.429	0.500
B	0.700	0.714	0.607	0.500	0.500	1.000	0.571	0.500
GPI-1								
(N)	5	14	14	14	14	14	14	14
A	0.000	0.000	0.000	0.000	0.000	0.071	0.000	0.000
B	1.000	0.000	0.000	0.857	0.000	0.929	0.000	0.000
C	0.000	1.000	1.000	0.143	1.000	0.000	1.000	1.000
GPI-2								
(N)	5	14	14	14	14	14	14	14
A	0.000	0.714	0.000	1.000	0.071	0.000	0.571	0.214
B	1.000	0.286	1.000	0.000	0.929	1.000	0.429	0.786
GPI-3								
(N)	5	14	14	14	14	14	14	14
A	0.000	0.000	0.000	0.071	0.000	0.000	0.000	0.000
B	1.000	1.000	0.929	0.929	0.000	1.000	1.000	1.000
C	0.000	0.000	0.071	0.000	1.000	0.000	0.000	0.000

APPENDIX 1 (cont'd)

	Population							
Locus	1	2	3	4	5	6	7	8
MDH-1								
(N)	5	14	14	14	14	14	14	14
A	0.000	0.071	0.000	0.000	0.000	0.000	0.000	0.000
B	1.000	0.929	1.000	1.000	1.000	1.000	1.000	1.000
MDH-2								
(N)	5	14	14	14	14	14	14	14
A	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
IDH-1								
(N)	5	14	14	14	14	14	14	14
A	0.000	0.000	0.000	0.143	0.000	0.000	0.000	0.000
B	0.600	0.000	0.786	0.857	1.000	0.000	0.000	1.000
C	0.400	1.000	0.214	0.000	0.000	1.000	1.000	0.000
AAT-1								
(N)	5	14	14	14	14	14	14	14
A	1.000	1.000	0.000	0.071	0.000	0.964	0.286	0.000
B	0.000	0.000	0.786	0.929	1.000	0.036	0.714	0.500
C	0.000	0.000	0.214	0.000	0.000	0.000	0.000	0.500

APPENDIX 1 (cont'd)

	Population							
Locus	1	2	3	4	5	6	7	8
PEP-1								
(N)	5	14	14	14	14	14	14	14
A	0.000	0.000	0.929	0.250	0.000	0.000	0.000	1.000
B	0.500	1.000	0.071	0.750	1.000	1.000	1.000	0.000
C	0.500	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PEP-2								
(N)	5	14	14	14	14	14	14	14
A	0.000	0.000	0.000	0.250	0.357	0.000	0.000	0.000
B	0.000	0.000	0.500	0.571	0.429	1.000	0.000	0.536
C	1.000	0.786	0.500	0.179	0.214	0.000	0.679	0.464
D	0.000	0.214	0.000	0.000	0.000	0.000	0.321	0.000
ME-1								
(N)	5	14	14	14	14	14	14	14
A	1.000	0.036	0.250	0.786	0.071	0.000	0.143	0.071
B	0.000	0.964	0.750	0.214	0.929	1.000	0.857	0.929

APPENDIX 1 (cont'd)

	Population							
Locus	1	2	3	4	5	6	7	8
FUM-1								
(N)	5	14	14	14	14	14	14	14
A	0.000	0.000	0.000	0.000	0.357	0.000	0.000	0.000
B	0.600	1.000	0.000	0.000	0.643	0.929	1.000	0.000
C	0.400	0.000	1.000	1.000	0.000	0.071	0.000	1.000
6PG-1								
(N)	5	14	14	3	14	14	14	14
A	1.000	1.000	0.000	0.000	0.000	1.000	1.000	0.000
B	0.000	0.000	1.000	1.000	1.000	0.000	0.000	1.000
GP-1								
(N)	5	14	14	8	14	14	14	14
A	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.250
B	1.000	0.000	1.000	0.125	0.500	0.536	0.000	0.750
C	0.000	1.000	0.000	0.875	0.500	0.464	1.000	0.000
GP-2								
(N)	5	14	14	10	14	14	14	14
A	0.000	0.929	0.464	0.250	0.000	0.929	0.857	0.357
B	1.000	0.071	0.536	0.550	0.000	0.071	0.143	0.643
C	0.000	0.000	0.000	0.200	1.000	0.000	0.000	0.000

APPENDIX 1 (cont'd)

	Population							
Locus	1	2	3	4	5	6	7	8
GP-3								
(N)	5	14	14	7	14	14	14	14
A	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.214
B	1.000	1.000	0.929	0.571	0.929	0.107	1.000	0.786
C	0.000	0.000	0.071	0.429	0.071	0.893	0.000	0.000

APPENDIX 2

Significance of departures of genotype frequencies from Hardy-Weinberg expectations for eight populations of *E. bislineata.*

Population	Proportion Significant Using Levene 1949 Test	Proportion Significant Using Exact P Test	Number Significant Departures (-)	Number Significant Departures (+)
1	2/4	2/4	2	0
2	4/6	4/6	4	0
3	6/9	6/9	6	0
4	10/11	9/11	8	1
5	7/7	7/7	6	1
6	3/6	3/6	3	0
7	5/6	5/6	5	0
8	6/8	5/8	5	0

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Volume 30 Number 3 September 1994

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DISTRIBUTIONAL RECORDS OF *GERRHONOTUS OPHIURUS* COPE, (SQUAMATA: ANGUIDAE), IN THE STATE OF HIDALGO, MÉXICO

Fernando Mendoza Quijano, Arturo Gonzalez Alonso, Tizoc Altamirano Alvarez, Rodolfo Garcia Collazo, and David A. Good

The alligator lizard genus *Gerrhonotus* ranges from the Edwards Plateau of central Texas through eastern and central Mexico to Chiapas, Oaxaca, and Guerrero (Smith and Taylor, 1950; Tihen, 1948; Smith, 1984; Good, 1988, 1994). It occurs over a wide elevational range in a variety of habitats from semidesert to pine forest (Good, 1988).

Until recently the genus was thought to contain only two species: *G. lugoi*, known only from the Cuatro Ciénegas region of Coahuila, and the widespread *G. liocephalus*. Seven subspecies have been described within the latter taxon, and an eighth has been proposed but not formally described (Smith, 1984). Good (1994) considered that four of these subspecies (*aguayoi*, *austrinus*, *loweryi*, and *taylori*) are poorly defined and should not be recognized. He summarized current knowledge of "intraspecific" taxonomy in *G. liocephalus* and proposed that it contains three species: *G. infernalis* (including the former subspecies *infernalis*, *aguayoi*, and *taylori*), *G. liocephalus* (*liocephalus* and *austrinus*), and *G. ophiurus* (*ophiurus* and *loweryi*).

Good (1994) recorded a single *G. ophiurus* locality in the northern corner of the Mexican state of Hidalgo (Jacala). The purpose of the present note is to document two other distributional records in the state.

The nearest populations to Jacala reported by Good were in northern (1.5 mi N of Zapotalillo or Zapotillo) and central (Córdoba and Orizaba) Veracruz. The former locality is 150 km and the latter 230 km from Jacala. On 9 January 1991, one of us (TAA) collected a female *G. ophiurus* (MZFC-5748; Fig. 1) from EL Chilaco, Vega de Meztitlán, Municipality of Meztitlán, Hidalgo (20° 40' 08" N, 98° 50' 16" W, SPP, 1982) at an elevation of 1260 m (Fig. 2). The locality was characterized by xerophytic scrub (Rzedowsky, 1981). The specimen was collected on a rocky slope dominated by mesquite (*Prosopis juliflora*) and huizache (*Acacia farnesiana*).

This specimen is in accord with most of the characters described by Tihen (1948) and Smith (1984) for *G. l. loweryi*. However, that taxon was synonymized with *G. ophiurus* by Good (1994). Table 1 summarizes scalational and morphometric characters in *G. ophioris* in general (from Good, 1994), in our specimen, and in LACM 109677, a specimen also from Hidalgo (Santa María) but unreported by Good. Morphometric measurements were made to the nearest mm using either a ruler or calipers.

Santa María is 18 km SW of Jacala. However, our collection from Chilaco is 63 km SSE of Jacala and therefore helps to fill the hiatus between Jacala and the populations in northern and central Veracruz. In order to better understand the geographic relationships among the populations of this species (and possible sympatry with *G. infernalis*, Mendoza and Good, in prep.) careful collecting in Veracruz, Tamaulipas, San Luis Potosí, Hidalgo, and Querétaro is needed.

Acknowledgments

We thank Hobart M. Smith for comments on preliminary drafts of this manuscript. We also would like to thank Robert L. Bezy (LACM) for the loan of comparative material. FMQ is grateful for logistic support to DGAPA, project IN 201789.

Table. 1. Character states in *G. ophiurus* (from Good, 1993) and in the specimens reported here from El Chilaco and Santa Maria for characters cited by Good (1993) as being important in distinguishing among the species of *Gerrhonotus.*

Character	*G. ophiurus* (Good, 1993)	MZFC 5748 El Chilaco	LACM 109677 Santa Maria
Canthals + loreals	4 - 5	4	4
Supralabials	23 - 26	23	24
Preoculars	1	1	1
Transverse dorsals	50 - 55	55	49
Longitudinal dorsals	16	16	16
Caudal whorls	145 - 160	149	Regenerated
Dorsal crossbands	10 - 11	10	10
Ventral pattern	Immaculate or Laterial spots	Immaculate	Lateral spots
Lateral fold bars	Present	Present	Present
Female head width/SVL	0.115 - 0.136	0.127	0.125

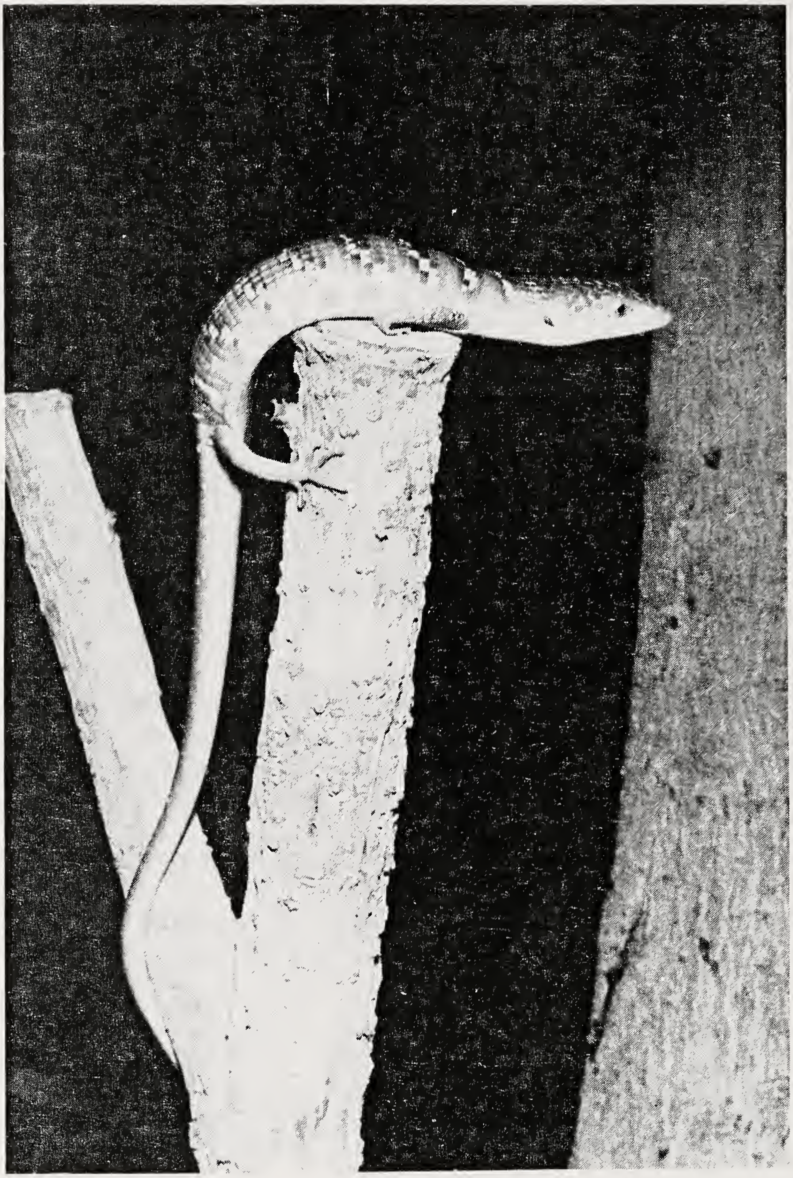

Fig. 1. *Gerrhonotus ophiurus* (MZFC 5748) from El Chilaco, Vega de Meztitlán, Hidalgo (elev. 1260m). This specimen is 108.2 mm SVL.

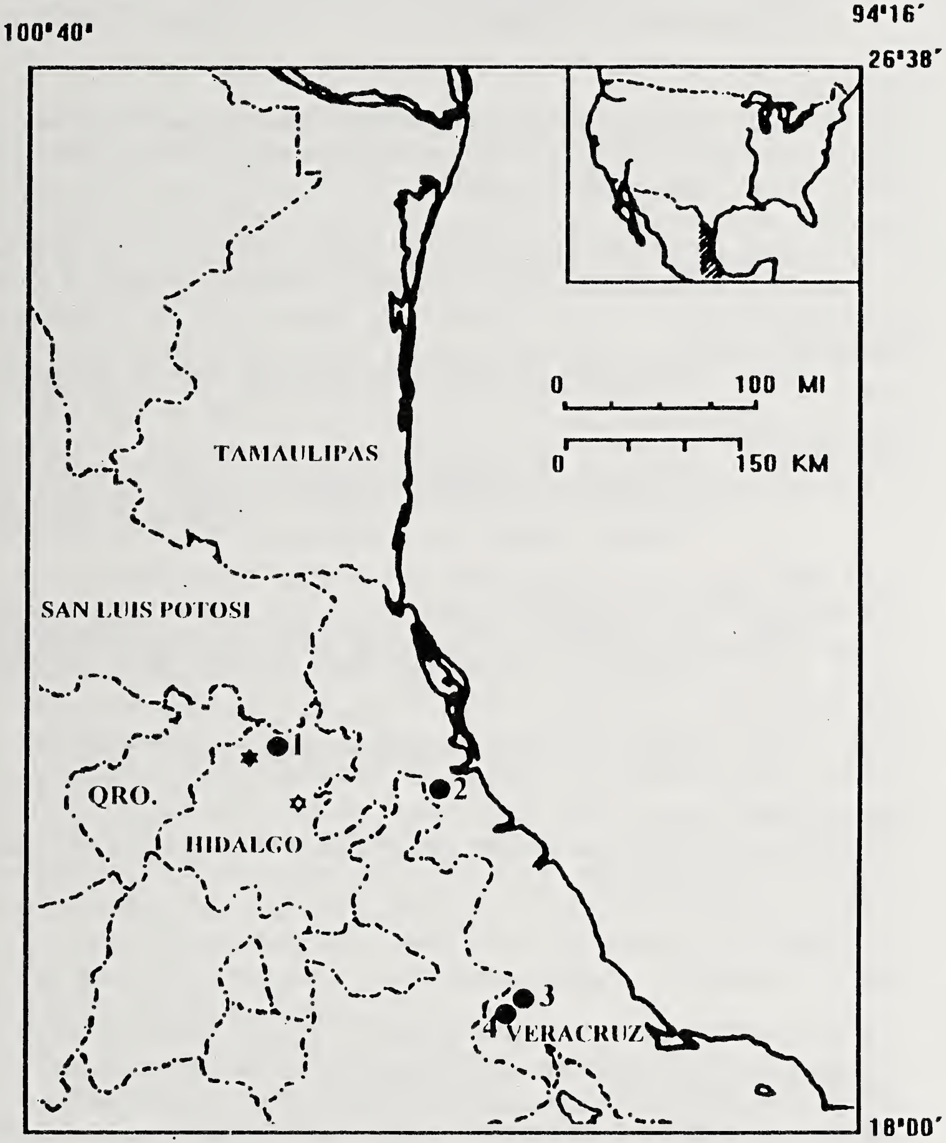

Fig. 2 Distribution of *Gerrhonotus ophiuurus* localities discussed in the text. The solid dots indicate previously published localities (Good, 1993). 1 = Jacala, Hidalgo; 2 = Zapotatillo or Zapotillo, Veracruz; 3 = Córdoba, Veracruz; 4 = Orizaba, Veracruz. The solid star indicates Santa María, Hidalgo, and the open star indicates El Chilaco, Hidalgo.

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A BEHAVIOR RESEMBLING "DEATH-FEIGNING" IN THE EASTERN SLENDER GLASS LIZARD, *OPHISAURUS LONGICAUDUS*

The behavior of "death-feigning" is commonly known to occur, and is also well documented, in a number of species of the reptilian suborder Serpentes, and in particular *Heterodon platirhinos* and *Hemachatus haemachatus.* Conversely, the occurrence of this behavior in suborder Lacertilia is not well documented. Smith (Handbook of Lizards, Vol. 4, Comstock Publishing Co., Ithaca, N.Y., 1946) mentions the utilization of "death-feigning" in *Gerrhonotus m. multicarinatus* in which specimens "pretend to be dead, lying limply and motionless" as well as a behavior described by Smith as "playing possum" in *Phrynosoma p. platyrhinos* and *Urosaurus graciosus.* However, a computer-assisted search of the literature failed to produce any reference to "death-feigning" in the genus *Ophisaurus.* The following note outlines the occurrence of a behavior resembling this in *Ophisaurus longicaudus.*

On 12 September 1991 at approximately 1800 hrs. an adult male *Ophisaurus longicaudus* was encountered crossing State Dam Road in Jasper County, South Carolina. When approached the animal immediately retreated into an extensive pine-wire grass savannah bordering this segment of the road. After several minutes of careful searching, the animal was located resting within a dense growth of wiregrass (*Aristida* spp.). Upon being restraining the lizard thrashed vigorously for several seconds and then abruptly lost all rigidity within its' body and became completely limp, and based on all outward appearances, was believed to be dead. Unlike the behavior sequence often demonstrated by the snake *Heterodon,* the lizard did not attempt to overturn itself when righted and showed no movement or response to stimulation around the eyes or mouth. During the entire time the animal was being restrained for measurements it remained in this condition (approximately 10 minutes).

It was subsequently placed in a small plastic holding container and set in the rear of the vehicle. After approximately twenty minutes the container was inspected and some slight movement of the lizard was noted. Shortly thereafter it was observed attempting to right itself within the container and within thirty minutes had resumed normal movement and activity; actively seeking a means of escape from the holding container. Observations continued until approximately 2300 hrs. at which time it was released at the location of capture.

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A POPULATION OF *CAIMAN LATIROSTRIS* AT 800 M ABOVE SEA LEVEL

Angel Alberto Yanosky

A population of *Caimen latirostris* located in El Bordo (province of Salta, Argentina) at 800 m above sea level was surveyed during six days in April 1992. This caiman population has coexisted with man since the Spanish colonization and the surveyed population can be traced down for approximately a century where the species occupied artificial lagoons used for crop irrigation. The population was evaluated through night counts and captures. El Bordo holds a population of at least, 77 individuals, with a density of 10 - 13 ind/ha of open water, though the number could be as high as 141 caimans due to flash-light sampling error. A fixed female:male ration of 1:2 was found by repeatedly captures. A possible irregular pattern in reproduction could be indicated by the age/size distribution. This species is perhaps one crocodilian species that is able to tolerate low temperatures, adverse weather conditions at these high elevations.

The broad-nosed caiman (*Caiman latirostris*) is one of the less known species of crocodilian (Yanosky, 1990) and ranges in Brazil, Bolivia, Uruguay, Paraguay and Argentina (Grenard, 1991; Groombridge, 1987). In Argentina, the species can be found in the provinces of Misiones, Corrientes, Entre Ríos. Santa Fe, Chaco, Santiago del Estero, Formosa, Jujuy, Salta and, occasionally in Buenos Aires (Yanosky, 1990). The presence of the broad-nosed caiman in the province of Salta has been noted recently (Medem, 1983, p. 186) with two localities: 40 km north to Guemes and Bañados del Quirquincho. In 1973, Medem was informed about broad-nosed caimans living at 800-900 m above sea level in the province of Salta and he concluded that the unexpected presence of this caiman on the slopes of the Andes, is possibly due to this species; tolerance of low temperatures. This information has been cited but never investigated.

Materials and Methods

During a visit to Salta, a population of broad-nosed caimans was surveyed during six nights from 6 to 12 of April, 1992. A headlight 800 m (Woodward & Marion, 1978, Wood *et al.*, 1985) of effective distance was used for counting caimans and estimating the length according to head size (Yanosky, 1990). Two countings were made on two consecutive nights. For four nights, caimans were captured with a lasso (Yanosky, 1990) by means of lighting and tagged with cattle-tags on the third caudal crest. During daylight, efforts were made to evaluate surrounding areas for caimans and describe the type of habitat.

Results

The population of broad-nosed caimans were found 8 km from Guemes and 60 km from Salta city within the Chaco biogeographical region (Cabrera & Willink, 1973) at 800 m above sea level. The annual mean temperature is 20° C with rainfall occurring principally in December and February.

Caimans were found in two neighboring manmade 3.5 m deep pools built more than a century ago. Mojotoro river provides flowing water to these pools. The surfaces of the pools are clean without emergent vegetation except for a sector where cattail *Typha* sp. is rooted.

These pools are surrounded by 30-60° slopes with forests comprised of *Prosopis alba*, *Urera* sp., *Caesalpinia paraguariensis*, *Chorisia* sp. and *Zizyphus mistol*.

The counting of caimans (Table 1) during the two first nights gave 23 and 24 animals; subsequently 35 were counted (60-70%) in one pool. In the other pool, 21, 31, and 34 were counted when actually at least 42 were observed (50-80%). By these methods, at least 77 animals were present but density could be between 100-140. Minimal counts gave a population of 44 animals in both pools and according to Taylor & Neal (1984) could be 20-25% and the population could be estimated at more than 180 animals. This population has a density of 10-13 ind./ha based on our data.

Most of the animals surveyed were up to about 1 meter in length (65.8%), followed by animals 1-2 meters long (31.7%) and finally animals (no more than 2 counted) over 2 m. (Table 1).

A total of six females and twelve males were captured during 4 consecutive nights (Table 2) with a sex ratio of 1:2. This ratio was maintained during the four capture periods. Two re-captures were obtained, one for each sex which according to Petersen's method (Telleria, 1986) indicates an underestimation of the population, with 45 animals.

Captures resulted in 33.3% for 1-2 m long animals and 66.6% less than 1 m long. No caiman more than 2 m was captured but they were observed during nights of captures.

Twelve individuals captured averaged 101.4 ± 6.6 cm (range 94-114) and five 161.6 ± 6.8 cm (range 155-172) long with one specimen between these two (129 cm in total length). If the population of caimans at El Bordo is composed of 77 individuals, 23.4% of the population was captured. It is important to note that hatchlings (<50 cm) were not present in captures and there absence here was confirmed by intensively searching the shores where hatchlings would be expected to occur.

A survey on the hilly surrounding area revealed only one nest active and two inactive. The active nest was composed of 8 eggs (a low number for the species, Yanosky, 1990) and an open egg showed a developed embryo assignable to Ferguson's (1987) 27th stage. Both inactive nests were assignable to the 1989 reproductive season.

Two specimens, a male 97.8 cm and female 96.5 cm long, had two limbs missing. The female was malnourished and the body was totally covered by mosses; usually due to inactivity. Malnutrition and severe aggression are common in dense broad-nosed caiman populations (Yanosky, 1990).

Historically, local people have existed with this population since 1908; with data of the caiman presence since the Spanish colonization when watering system pools were built for crops.

Discussion

El Bordo holds at least a population of 77 broad-nosed caimans with a minimal density of 10-13 ind./ha. Sex ratio of 1:2 (female-male) has been reported in crocodilian populations (Fitzgerald, 1987; Joanen, pers. com.). Recent studies have demonstrated that this is not significant from 1:1.

The presence of juvenile specimens up to about 1 m. long indicates a 1989 reproduction while the age of the second group (1.6 - 1.7 m.) is estimated 6 - 8 years. All data seem to indicate that there were no hatchlings in 1990-91, as at least signs of nesting should have been found. The finding of two nests assignable to 1989 is in agreement with the group 1 m long. The lacking of all sizes and the grouping in three characteristic classes could be due to irregular reproduction. This population may not breed every year, which could be physiological adaptation for living in such an adverse climate. This population occurs at the highest elevation known for the species. Additional studies are needed on this species.

Table 1. Night counts of broad-nosed caimans in Salta. Numbers of individuals are depicted within three size classes together with the pertinent percentage. Counts 1-3 belong to one artificial pool and 4-7 to another one.

Counts	<1 m	1 - 2m	> 2m
1	24-68.6%	10-28.6%	1-2.8%
2	15-62.5%	9-37.5%	—
3	17-73.9%	4-17.4%	2-8.7%
4	20-58.8%	14-41.1%	—
5	22-70.9%	8-25.8%	1-3.2%
6	31-73.8%	10-23.8%	1-2.3%
7	11-52.4%	10-47.6%	—
total	140	65	5
average	20-65.8%	9.3-31.7%	0.7-2.4%
St. dev.	6.5-8.2	3-10.7	0.7-3.1
range (%)	52.4-73.9	17.4-41.4	0-8.7

Table 2. Captures of broad-nosed caimans during four consecutive nights in Salta, Argentina.

Night	Captures Females/Males	Hours spent	Recaptures
1	1/2	4	—
2	3/6	5	2
3	1/2	5	—
4	1/2	5	—

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NOTEWORTHY LIZARDS OF THE GENERA *PHRYNOSOMA* AND *SCELOPORUS* IN THE MUSEO DE ZOOLOGÍA "ALFONSO L. HERRERA"

Hobart M. Smith and Oscar Flores Villela

The fledgling Museo de Zoología of the Facultad de Ciencias (MZFC), Universidad Nacional Autónoma de México, has rapidly acquired a herpetological collection of potentially major significance and great promise for the future (Flores et al., 1991) as a central depository for research programs under the auspices of the Facultad de Ciencias, UNAM, in collaborative, mutual dedication of all to the understanding and protection of Mexico's biological wealth. The museum's first herpetological catalog documents its progress (op. cit.). It is our purpose here to contribute to a future, second edition of that catalog, with attention solely to certain notable members of the genera *Phrynosoma* and *Sceloporus*.

Phrynosoma douglasi brachycercum Smith

We have re-examined the specimen (MZFC 3101) reported (Flores et al., 1991: 106) from La Ordoña, Cañada de San Juan, municipality Fresnillo, Zacatecas, inasmuch as the species had not previously been reported from that state, where *P. orbiculare*, which is very similar in many respects, is known to occur. We confirm the identification and the validity of the state record. The specimen is a female 50 mm s-v; tail mutilated. The considerable distance between the occipital horns (~3.5 times largest basal diameter of one of the horns), their relatively small size (about equal to the rear superciliary horn) and the distinct notch between them assure assignment to *P. douglasi* (spelling fide Hammerson and Smith, 1991). Although the tail is mutilated, it appears to have been much shorter than width of head when complete. The gular scales are strongly convex, and the chest scales weakly keeled. In all these respects the specimen conforms with *P. d. brachycercum*, previously recorded only from Chihuahua and Durango.

Sceloporus aeneus aeneus Wiegmann

A single specimen (MZFC 3469), supposedly from Balsas, Guerrero (and so reported by Flores et al., 1991: 109), belongs to this subspecies, but the locality data are wrong. The specimen bears the field number 1710 and, as entered in the field catalog, was taken July 10, 1932, by HMS and E. H. Taylor at "Km 63 between Mexico City and Cuernavaca, Morelos." We have also re-examined MZFC 3468, from Tres Marias (now Tres Cumbres), Morelos, and have confirmed its identity as *S. a. aeneus*, as reported in Flores et al. (loc. cit.); it was taken by the same collectors, July 7, 1932.

Sceloporus exsul Dixon et al.

Ferguson (1982: 183) recorded a total of eleven specimens known of this species, although only seven in the published literature (Dixon et al., 1972; Sites and Haiduk, 1979). All eleven were taken near Peña Blanca, Querétaro, as was the specimen here noted (MZFC 826), from 4 km S Peña Blanca (Flores et al., 1991: 112). However, external features have been described only for the original hypodigm of six specimens, all young except for the holotype male.

The MZFC specimen is an adult female, 54 mm s-v. Most features conform with published variational limits; the dorsals number 31, the scales between femoral pore series are 8, the prefrontals are in contact medially, the tail is unicolor dorsally, not banded, and there are five and two half-rows of scales between the dorsolateral light stripes. However, the femoral pores total 23 (11-12) rather than 27-30, and the posterior half of the dark stripe bordering the dorsolateral light line medially is broken into a series of seven separate dark spots. Adult females may more frequently have that dark stripe broken into separate spots than do males.

We concur with Ferguson's (1982) assignment of this species, along with *S. cautus*, to the *spinosus* rather than the *undulatus* group.

Sceloporus magister bimaculosus Phelan and Brattstrom

A single small juvenile (MZFC 3179B), 38 mm s-v, is from 3 km SW Rancho Los Rosales, Mapimi, Durango, and was previously reported (Flores et al., 1991: 131) as *S. p. parvus*. It is typical of its race, having a paravertebral series of dark spots, as well as the contact of labiomentals with the mental, broad contact of rear supraoculars and median head scales, and a prominent dark bar in front of arm insertion. The species is well known from the Mapimi area (e.g., Barbault and Grenot, 1977: 2281), but the subspecies has not previously been correctly noted from the state.

Sceloporus siniferus siniferus Cope

Two specimens are of special interest. One (MZFC 2030), from Laguna de Tres Palos, Acapulco, Guerrero, is listed in Flores et al. (1991: 124) as *S. maculosus*. It is, however, typical of *S. s. siniferus*, having keeled preanals and ventrals, two postrostrals, short ear lobules, and 6-7 femoral pores, as well as the typical dorsal and throat/chin markings. It is a female, 51 mm s-v.

The other specimen (MZFC 4749) was taken 2 km from Santa Maria Chimalapa, Oaxaca, 430 m. It is a male, 49 mm s-v, typical of its subspecies, with 5-5 femoral pores, 32 dorsals, two postrostrals, keeled preanals, smooth ventrals, no enlarged postanals, and two canthals. It is the only example of the species to be reported from Atlantic drainages; otherwise the species is known only from Pacific slopes. The closely related *S. carinosus* might well have been expected there, having been reported nearby on the Rio Negro, Oaxaca (Smith, 1992: 196).

Sceloporus spinosus caeruleopunctatus Smith

Three specimens (MZFC 530) of this subspecies were reported by Flores et al. (1991: 134) from the Zoological Gardens of Tuxtla Gutiérrez, Chiapas. They indeed belong to that subspecies, all having 11-11 femoral pores, 5-5 supraoculars and 33-34 dorsals (Smith and Chiszar, 1992), but they certainly do not natively occur in Chiapas. They presumably were kept as captives at the zoo, although they could have become feral, once released or escaped there.

Sceloporus teapensis Günther

A single specimen (MZFC 5061) was taken 2 km from Santa Maria Chimalapa, Oaxaca, 430 mm. It is a juvenile female, 38 mm s-v, with a single canthal, 45 dorsals, and 9 rump and 11 nape rows. It thus conforms with the distinguishing features of the species, which a study in progress reveals is not a subspecies of *S. variabilis*. A newly discovered character distinguishing the two species is the relatively large size of the preinguinal scales in S. *teapensis*, as in the present example. The locality is near the southern limit of distribution of the species in the area of the Isthmus of Tehuantepec, where it may be limited to Atlantic slopes, whereas its close relatives *S. smithi* and *S. v. variabilis* appear there to be limited to Pacific slopes. Elsewhere the latter taxon occurs also on Atlantic slopes.

Sceloporus undulatus consobrinus Baird and Girard

Three specimens are especially noteworthy. An adult male, 60 mm s-v (MZFC 1815), from 8.7 mi N Cuauhtémoc, Chihuahua, was referred to *S. p. parvus* by Flores et al (1991: 131). The latter species has postfemoral dermal pockets and is out of the question for this specimen, which lacks them. Its external features do not differ from those characteristic of *S. u. consobrinus.*

Likewise referred (loc. cit.) to *S. p. parvus* is a specimen (MZFC 3179A) from 3 km SW Rancho Los Rosales, Mapimi, Durango (MZFC 3179B is *S. magister bimaculosus*, q.v.). It too is an adult male (56 mm s-v) *S. u. consobrinus* with typical external features of that taxon.

A juvenile male (MZFC 3510), 35 mm s-v, is from Hda. de Vallejo, Villa Guadalupe, Santa Teresa, San Luis Potosi, and was referred to *S. maculosus* by Flores et al. (1991: 124). The latter species, however, has a number of peculiarities, including a postfemoral dermal pocket, absence of postrostrals, femoral pore series separated by only one or two scales, and postanals not or little enlarged in males. None of these features occur in the present specimen, which is typical of immature individuals of *S. u. consobrinus.*

Sceloporus virgatus Smith

Dominguez et al. (1977: 132) reported two specimens of this species from Chihuahua. A hatchling male (Colección Biológica [CB] de la Fauna Silvestre, in the Instituto Politécnico Nacional, no. 7938), 28 mm s-v, appears to be representative of the species to which it was assigned. Its chief critical features are its dorsolateral light lines, more or less unicolor dorsum and sides, immaculate ventral surfaces, and notched femoral pores (Cole, 1963). It was found in a typical habitat of oak-pine forest on Sierra de San Luis 65 km NW Janos, within the known range of the species.

However, the other specimen (CB 7937) referred by Dominguez et al. (loc. cit.) to *S. virgatus* came from a locality in the Samalayuca sand dune area 10 km S, 30 km W Cd. Juárez, far out of the known range and habitat of that species. It is an adult male 56 mm s-v with clearly visible although small and weakly defined gular and abdominal semeions; *S. virgatus* has no abdominal semeions and smaller gular semeions involving fewer than the 11-11 scales on the present specimen. The femoral pore scales are not notched, as they are in S. *virgatus*. The dorsal ground color is a light tan; the dorsolateral light stripes are well defined, sharp-edged, and occupy little more than two half rows; a median area two and two half scale rows wide is unicolor, and is bounded on each side by a light brown stripe one and two half scale rows wide, bordering the dorsolateral light line; a similar dark line borders the dorsolateral light line laterally; the abdominal semeions are dim (as are the gular semeions), apparently because of a thickened epidermis near ecdysis, but the dark abdominal borders do not reach either axilla or groin levels, are 2-3 scales wide, and are separated by a minimum of five scales, a maximum of eight. There are 17-17 femoral pores, four interfemoral pore scales, 35 dorsals, 6-6 supraoculars, and two postrostrals.

CB 7937 clearly is representative of *Sceloporus undulatus*, and at present is referable to *S. u. consobrinus*. In reality it belongs to an unrecognized and unnamed subspecies endemic to the Samalayuca and perhaps other, adjacent dunes. It is currently under study by HMS and Edwin L. Bell.

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OBSERVATIONS ON ACTIVITY IN TWO LIZARDS (*ANOLIS SCRIPTUS* AND *LEIOCEPHALUS PSAMMODROMUS*

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Temporal activity patterns are considered to be elements of an organism's ecological niche (Pianka, 1973). Here I examine activity patterns of two sympatric lizards (*Anolis scriptus* and *Leiocephalus psammodromus*) from Pine Cay, a small island in the West Indies. Schoener (1975) and Schoener and Adler (1991) have briefly noted the relationships of *Leiocephalus* spp. in the Bahamas; however these studies do not provide a detailed, quantitative assessment of the activity of these species (see Laska (1970) for a quantification of *A. scriptus* habitat use).

Pine Cay is a small (350 ha) relatively low (highest point < 3 m above mean sea level) island found in the Caicos Islands to the southeast of the Bahamian archipelago. The island is primarily covered with "dense scrub" and "mixed woodlands", however "open scrub" and "beach" habitats are prevalent on the leeward coast (see Iverson, 1979 for a more detailed description of the island).

I made a total of 1141 observations (638 *A. scriptus*; 503 *L. psammodromus*) between 13 July and 28 July 1991 (nearly 100 h were spent searching for lizards). I made no observations on lizards during or for 1 h following rain. My censusing procedure was similar to that used in several other studies (e.g., Rand, 1964; Schoener, 1975; Castilla and Bauwens, 1991; see Rand, 1964 for a discussion of potential biases of this method). I walked slowly along the edge of a path or road or along the beach watching for lizards. Upon observing a lizard, I recorded the species, time (all times EDT), and several characteristics of the microhabitat. Substrate characteristics recorded were: (1) rock, (2) litter, (3) bare/sand (either bare ground or sand), (4) grass, (5) on tree, (6) on wall, and (7) other. In addition, I noted whether the lizard was in an open (lizard had no vegetation directly overhead) or covered (lizard had vegetation directly overhead) site, and whether the lizard was in full sun, in a sun-shade mosaic, or in full shade. These variables are similar to those used by Rand (1964). Observation rate was calculated by dividing the number of lizards observed in an hour (e.g., 0800-0900) by the total amount of time I spent searching at that hour throughout the entire study period.

No individual was observed more than once a day (i.e., my path did not pass the same spot twice in a day). Because of this, observations on the temporal patterns of activity may be assumed to be independent (i.e., an observation of a lizard at a certain time on one day is independent of an observation of a lizard at a different time the next day). While this may not be strictly true, it is true enough for the preliminary observations given here.

Observation rate for *A. scriptus* showed a bimodal distribution. They were highest just after dawn (around 0600; ca. 17 h^{-1}), and just prior to dusk (around 2000; ca. 14 h^{-1}). In the middle of the day very few lizards were observed (< 2 h^{-1}). *Leiocephalus psammodromus* observation rates also showed a bimodal distribution. They were higher later in the morning (around 0900-1000; ca. 8 h^{-1}) and earlier in the afternoon (around 1600; ca. 8 h^{-1}) for *L. psammodromus* than for *A. scriptus*. Few observations were made in the middle of the day (< 3 h^{-1}).

There were shifts in microhabitat use with time in both species. Substrate utilization by *A. scriptus* changed from ground surfaces (e.g., litter, rocks, bare/sand) to tree surfaces (Fig. 1). This shift occurred early in the day (0700). A reciprocal switch occurred later in the day, around 1800. *Leiocephalus psammodromus* did not exhibit the same diel substrate shift (Fig. 1). *Leiocephalus psammodromus* preference for ground versus tree surfaces was relatively constant. *Leiocephalus psammodromus* were found on ground substrates more than 70 -75% of the time at all hours of the day.

As might be expected, the proportion of lizards of both species observed in full sun was lowest during the middle of the day (Fig. 2a). Early in the morning and late in the evening, anoles were found in full sun in high proportions (ca. 70% and ca. 75%, respectively). *Leiocephalus psammodromus* was primarily found in sun/shade mosaics. The use of open habitats showed the same general pattern as did use of full sun (Fig 2b).

Anolis scriptus shows shifts in their use of microhabitats (substrates, shade and cover) whereas L. *psammodromus* shows shifts only in their use of shade and cover. Similar diel changes in use of shaded microhabitats have been observed in related species. *Leiocephalus schreibersi* increases use of shaded microhabitats later in the day (Marcellini and Jenssen, 1989). Schoener (1970) observed a similar pattern in *Anolis grahami* (but he also saw the opposite pattern in two species sympatric with *A. grahami*).

Why *A. scriptus* and *L. psammodromus* show the patterns of habitat and microhabitat use observed in this study is unknown. There at least two possible explanations. The first is that there is or has been competition between A. *scriptus* and *L. psammodromus*. The different habitat and microhabitat use of these two species may represent resource partitioning (see Schoener, 1977). A second possible explanation is that each species has a set of specific physiological, nutritional, or social requirements, and their microhabitat and habitat use patterns are simply reflections of these requirements (see Barbault, 1991). While the present study cannot provide direct answers to whether or not competition is occurring, or whether abiotic factors are influencing the interaction (or lack thereof), it does suggest that an investigation into the temporal changes in microhabitat use (and potential concomitant changes in food availability, etc./) would be useful.

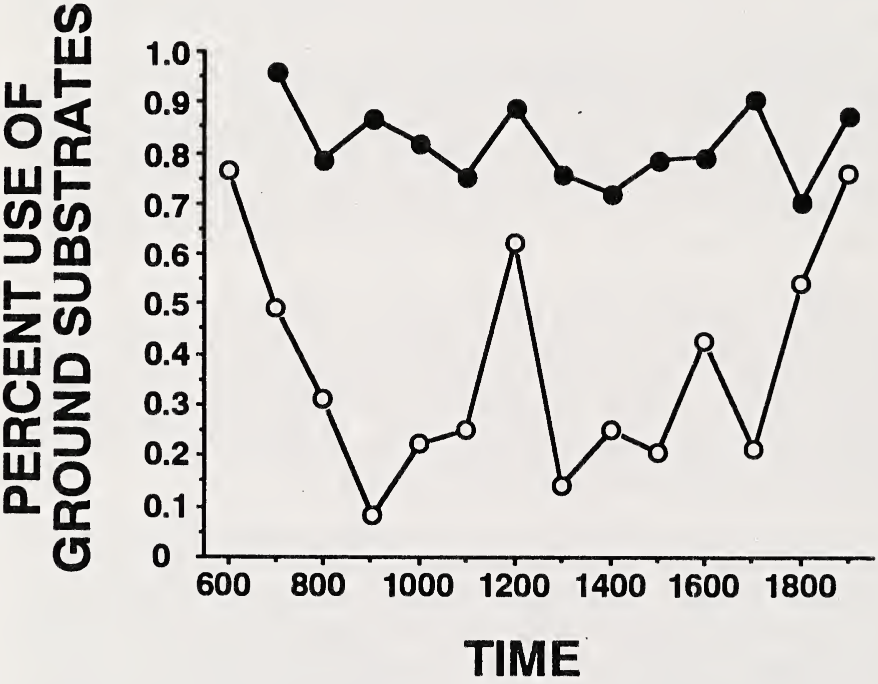

Fig. 1. Relative use of ground substrates by hour for *Anolis scriptus* (open circles) and *Leiocephalus psammodromus* (closed circles).

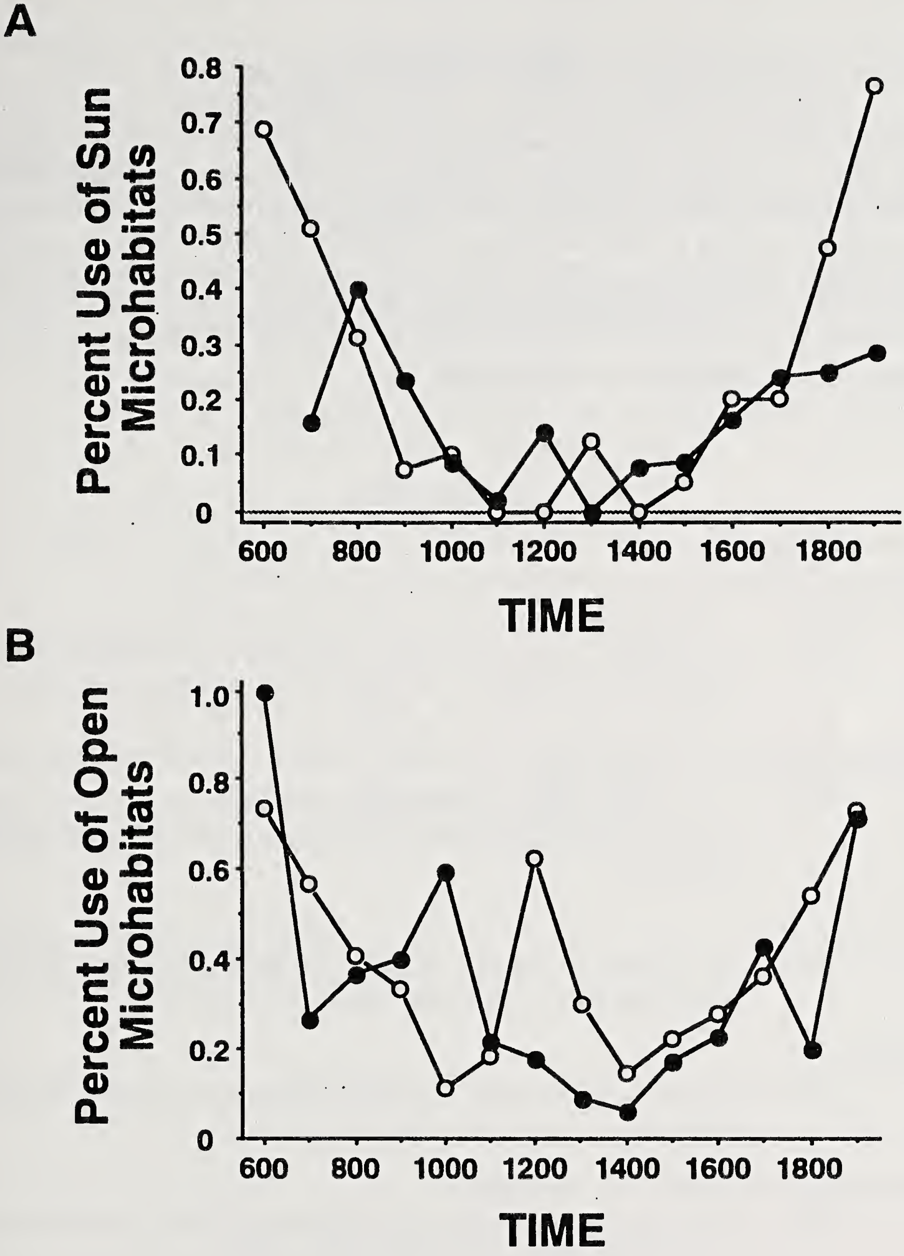

Fig. 2. a) Diel pattern of proportional use of microhabitats in full sun by *Anolis scriptus* (open circles) and *Leiocephalus psammodromus* (closed circles). b) Diel pattern of proportional use of open mcrohabitats by *A. scriptus* (open circels) and *l. psammodromus* (closed circles).

Acknowledgments

I thank J. Garis, manager of the Meridian Club, P. Neis, and the residents of Pine Cay for their assistance and hospitality during my stay on Pine Cay. J. Iverson generously provided his field notes. R. Ballinger, T. Joern, J. Rowe, and several anonymous reviewers provided helpful comments on earlier versions of this manuscript. Support was provided by an NSF predoctoral fellowship, a Gaige Fund award from the American Society of Ichtyologists and Herpetologists, the H. Holck fund of the UNL School of Biological Sciences, and T. and J. Smith. J. Rettig has been a constant source of encouragement and support.

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A SCANNING ELECTRON MICROSCOPE STUDY OF THE LARVAL LABIAL TEETH OF *RANA MONTEZUMAE*

John K. Korky and Robert G. Webb

Gosner (1959) and Faier (1972) demonstrated that larval labial teeth vary in size and morphology. Although routine use of the scanning electron microscope (SEM) for taxonomic purposes may not be practical, such data may be useful for taxonomic decisions, if the variations are not associated with ecological functions. Altig (1973) and Altig and Pace (1974) reported SEM data from a variety of species and commented on intra- and interspecific differences. The latter study included total length and basal width measurements of individual teeth for 37 amphibian species, including 12 ranids. The ranid data for total length range were 0.035-0.120, mean 0.081, and basal width range 0.027-0.073, mean 0.047. Taylor (1942) first described the larvae of *Rana montezumae* based on limited samples. Korky and Webb (1992) redescribed the larvae using a larger sample of 30. The purpose of this study is to: (1) describe the SEM morphology of the labial teeth; and (2) compare the total length and basal width measurements of R. *montezumae* teeth to those of other ranids reported by Altig and Pace (1974).

The terms, tadpole and larva, are used interchangeably. The term, tooth, is used for the keratinized labial structures that are functionally similar to vertebrate teeth. These labial teeth are arranged in transverse rows, and as a whole are assumed to act as a rasping organ for the removal and breakup of food. The teeth of each row are curved orally. How the various morphological features of a tooth may select a type of food or substrate are undetermined. Tooth terminology and larval stage follow Gosner (1960). Teeth in this study were extracted under a dissecting microscope from the center-left of A-1 (terminology of Altig, 1970). The specimen (UTEP 7509, Laboratory for Environmental Biology. The University of Texas at El Paso) was stage 34, total length 54 mm. Korky and Webb (1992) reported a tooth-row formula of 2(2)/3(1) for most larvae of *R. montezumae.*

Teeth were placed on a specimen stub with double-faced tape. Prepared stubs were sputter coated with gold and examined and photographed using a Jeol JSM-25S2 scanning electron microscope. Individual tooth measurements follow the method of Altig and Pace (1974). Gosner (1959) reported that the genus *Rana* varies intra- and interspecifically in the presence of denticulations (= serrations) on the margins of the tooth head. He listed seven North American ranids with the number of denticulations ranging from 6-15, whereas eight others showed a reduction in the number of serrations continuously ranging from 2-6, to those lacking serrations entirely. He placed *R. pipiens* in this latter group and noted non-serrate teeth as "uncommon" in this species. Since his *pipiens* samples came from New Jersey, Georgia, South Carolina, and Oaxaca, Mexico, without more specific locality data for specimens measured, we cannot say with certainty what species his samples represent in light of more recent taxonomic designations Hillis (1988).

Figures 1 and 2 show a labial tooth-row of *R. montezumae* with orally curved heads that lack serrations on the margins. Fig. 3 shows a single tooth with a total length of 0.110 mm and a basal width of 0.055 mm. Hillis (1988) included *R. montezumae* in the Alpha division of the *Rana pipiens* complex. Korky and Webb (1992) commented on the comparison of *R. montezumae* larvae to closely related species in the complex. Our tooth measurement data (Fig. 3) closely approximates that given by Altig and Pace (1974) for *R. pipiens*, total length 0.107 mm and basal width 0.061 mm. Unfortunately, like Gosner (1959), Altig and Pace (1974) do not specify the locality of their *pipiens* sample, thus, making any comparison tentative. We can say, however, that our tooth measurement data for *R. montezumae* are very close to that for *R. pipiens* (sensu lato) recorded by Altig and Pace (1974), and that the non-serrate margins we report for *R. montezumae* do also occur in some *R. pipiens* (sensu lato) as reported by Gosner (1959), thus, supporting the inclusion of R. *montezumae* in the *R. pipiens* complex. Further work on members of the complex would provide insight to delineate the range of size and structural variations, as well as variation due to use, ontogenetic, ecological, and geographic differences. Study of teeth from other than the A-1 row, and more individuals, would be useful in determining if individual variation exists between tooth-rows of the same or different specimens.

Acknowledgments

Dr. Stephen Koepp, Montclair State University, Biology Department, provided and directed use of the scanning electron microscope.

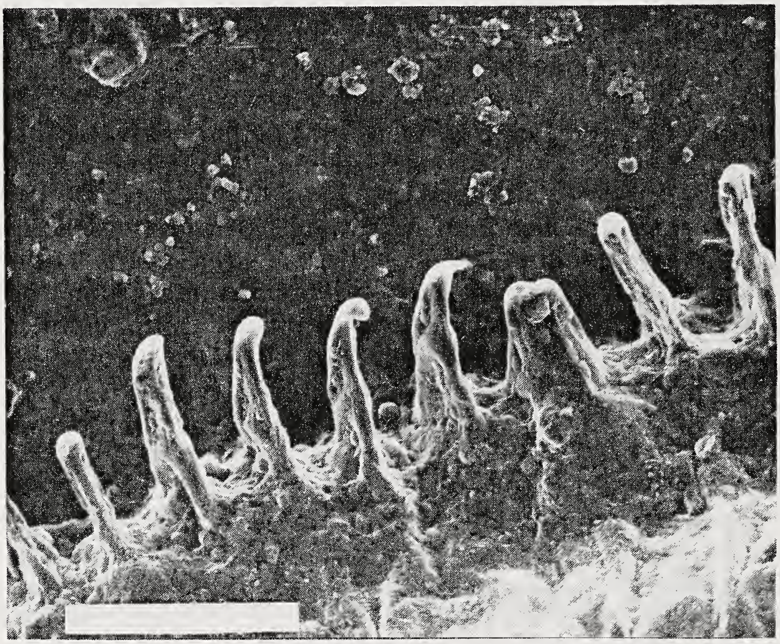

Fig. 1. Labial tooth-row of *Rana montezumae* with orally curved heads lacking serrations on the margins. (x 300, 15 kv). Scale equals 100 microns.

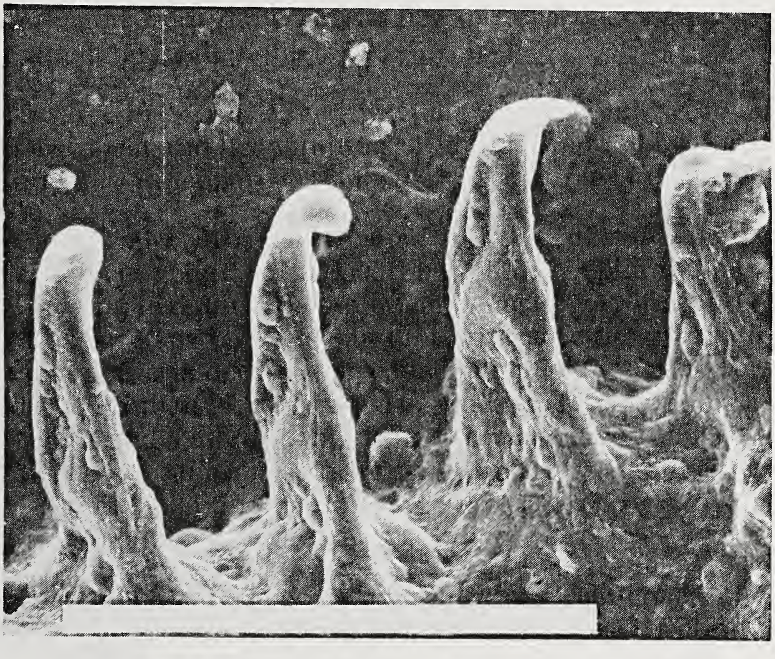

Fig. 2. Labial tooth-row of *Rana montezumae* with orally curved heads lacking serrations on the margins. (x 700, 15 kv). Scale equals 100 microns.

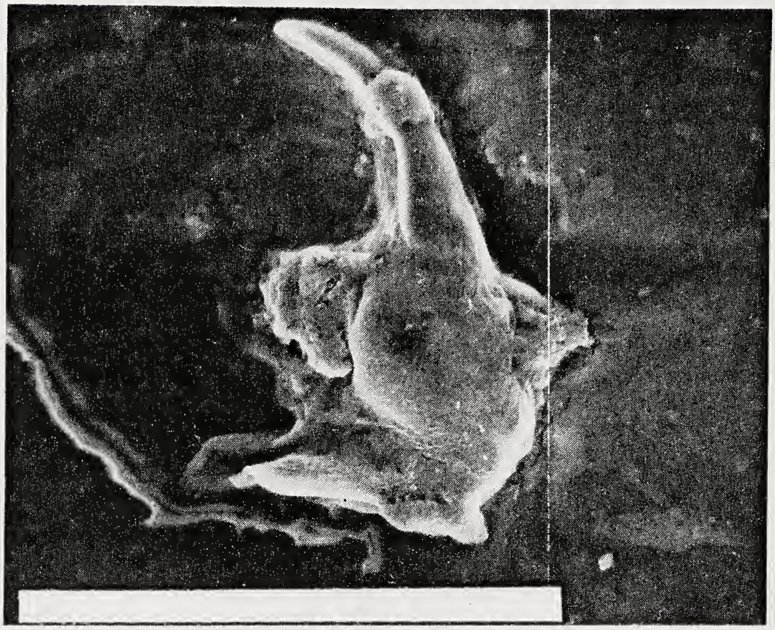

Fig. 3. Single tooth, total length 0.110 mm, basal width 0.055 mm. (x 700, 15 kv). Scale equals 100 microns.

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CARL AKELEY: AFRICA'S COLLECTOR: AFRICA'S SAVIOR

by Penelope Bodry-Sanders, 1991. Paragon House, 90 Fifth Avenue, New York, 10011, 298 pp. cloth. $19.95

Anyone enthralled in African adventure and wildlife, along with changes in our natural landscape will welcome this treasured volume. Not only do I find the life of this gifted naturalist, taxidermist, and inventor enlighting, but his close association with such naturalist as Martin and Osa Johnson, "Teddy" Roosevelt, and Roy Chapman Andrews, along with the communities of DeKalb and Chicago, Illinois will attract the attention of many of these readers.

Even though this book does not cover herpetology, it will certainly inspire those of us having visited either the Milwaukee, American Museum of Natural History, and especially those have visited the Field Museum of Natural History, where many of his diaorma's and bronze sculptures will captivate the mind of any casual observer.

While little is known of Carl's early childhood, it is known that he was born on May 19, 1864 in the small town of Clarendon, New York, to Julia Glidden and Daniel Webster Akeley. While a child Carl lost most of his brothers during infancy, and for this reason young Carl grew solitary and introspective. When Carl was 15 his relatives, Joseph Glidden of Dekalb, Illinois invited Carl to spend spring break with them. This was an inspiration that stimulated Carl's love for the midwest.

While a child in Clarendon, Carl developed his artistic ability for taxonomy. In 1883 at the age of 18 he became an apprentice at Ward's Natural Science Establishment in Rochester, New York, where he developed a new technique for mounting specimens in their natural poses. His first major project was mounting the remains of Barnums' famous circus elephant Jumbo. This superb mount was unveiled on February 2, 1886 in Rochester. Life at Wards' had been difficult, and in November 1886 Carl Akeley arrived in Milwaukee and was met by his old friend Wheeler. While at the Milwaukee Museum, Carl completed the first scientifically and artistical habitat display of any creature. This diorama of the muskrat group revealed the diversity and complexity of the ecosystem in which an animal lives. This group setting was completed in 1890, and is still on display in the Milwaukee Museum.

Carl was not satisfied at the museum in Milwaukee, and set up his business and studio in Dekalb, Illinois in 1892. His relationship with Milwaukee Museum continued, and Carl was commissioned work for many years thereafter.

In 1895 Carl and his assistant Mickie moved to Chicago to work at the nearly established Columbian Field Museum (present Field Museum) upon the request of Daniel Girard Elliott, the newly appointed director, and was offered a position in the taxidermy department on January 1, 1896. Shortly thereafter Carl patented a process for making artificial leaves and accessories. The patent rights were sold to the museum for $1.00, as Carl had no interest in the financial rewards.

In 1896, after having become a renowned taxidermist, Carl set sail for Africa with Elliott and associates. The thrill of such an adventure proved highly seductive, and from that day, Akeley became obsessed with the continent, for which he made numerous returns.

In 1909 while in Kenya, Akeley was charge by a bull elephant and suffered extensive chest and head injuries. This was followed by the killing of a wounded and furious leopard with his bare hands on a later expedition.

While Carl will always be remembered as the greatest taxonomist, he was also a mechanical genius. While working on an elephant display he developed a spray-gun to refinish the American Museum of Natural History. This machine was developed in 1910, and introduced to the public in New York. This cement gun was used for the construction of the Panama Canal and Hayden Planetarium. It also was used for lining the trenches in Europe during World War I, and a more sophisticated versions is being used today for construction of swimming pools. Carl had no interest in monitory reward and had given-up financial interest in the Cement Gun Company shortly after developing the gun.

The trying tails of Mickie and Carl's hunting experienced in Africa with Theodore "Teddy" Roosevelt, and Martin and Osa Johnson will enlighten the general reader. Anyone reading this excellent book will treasure this intimate portrait of a naturalist whose many contributions still, and will forever enrich our lives.

In his later years Carl became the founder of mountain gorilla conservation. In the 1920's he became alarmed over the decimation of these wonderful docile animals, and was instrumental in enlisting the Belgian government to establish the Parc National Albert, or the first Africa game reserve in 1925.

If you ever picked-up a book and never wanted to lay it down, this is another such volume that will provide many hours of vicarious enjoyment. The author is the lecture and literature coordinator for the American Museum of Natural History educational travel program, and led a safari to East Africa in 1989 to retrace the footsteps of Akeley's remaining days, and to rebuild his grave at Kabara. The author's ending epilogue is devoted to the backache and heartbreak incidents of getting from one locality to another, along with the "red-tape" involved.

The author should be commended for a volume which rivals, Beebe's, Martin and Osa Johnson's, Roy Chapman Andrews and Authur Loveridge numerous Africa adventures.

—Harlan D. Walley, Department of Biology, Northern Illinois University, DeKalb, Illinois 60115.

Received: 16 March 1994

AMPHIBIANS AND REPTILES OF CONNECTICUT AND ADJACENT REGIONS

by Michael W. Klemens, 1993, State Geological and Natural History Survey of Connecticut Bulletin No. 112. Hardcover. 318 pp. plus 32 color plates and 2 auxiliary maps. ISBN No. 0-942081-04-8.

Most regional faunas are written primarily from the literature. The author reviews publications of all kinds, including a large number of papers published over many years in scientific journals, then adds a relatively small amount of new information from his or her own experience, puts it all together in a (hopefully) organized and useful format, and *viola!* —a new regional fauna. This book by Dr. Michael Klemens is quite different. It consists mainly of his own observations and data obtained during 17 years of field work and data analysis. His findings are supplemented, to be sure, by a thorough review of existing literature, but the heart and soul of the book consists of his original work.

I am in no way trying to denigrate the other type of publication—the type resulting primarily from literature reviews. They serve a very real purpose. They bring together a great deal of information from widely scattered and often unavailable sources and put it under one cover where it can be used by people who do not have the time or inclination for an exhaustive literature review of their own.

Dr. Klemens' current contribution is a combination of the best of both types of publication. It presents an enormous quantity of new, original work, supplemented by, and integrated with, a thorough review of existing knowledge on the subject. The "Adjacent Regions" referred to in the title of the book refer almost exclusively to those counties of New York, Massachusetts, and Rhode Island which border on Connecticut. There are occasional references in the text to other counties and even other states, but these are not included in the geographic area which is covered in detail. If I had to make one suggestion for improving this book, it would be to drop the words "and Adjacent Regions" from the title.

The book contains accounts of all 22 species of amphibians and all 28 species of reptiles known to occur in Connecticut. Each species account is organized into five sections and seven sub-sections as follows:

Identification
Distribution
  a. General
  b. Regional
Life History and Ecology
  a. Habitat
  b. Activity
  c. Reproduction
  d. Size
  e. Food Habits and Predation
Conservation Status
Specimens Examined

These species accounts constitute the major portion of the book. Some species are covered in more detail than others, but all accounts are thorough, interesting, and informative. A detailed map of Connecticut, showing the species' distribution in the state, is included in each account.

There are 32 color plates in the center of the book. Each plate contains one to eight high quality color illustrations. All species covered in the text are illustrated at least once, and some are illustrated several times, including mature and immature stages, various color morphs, and both sexes. There are also a number of good photographs of the habitat in which various species have been found. I found these habitat photographs to be quite helpful in visualizing what I read in the text.

The last two color plates are maps of Connecticut. The first is a topographic relief map of the state with contour intervals of 500 feet. The second is a map showing the detailed locations of two prominent and ecologically important physiographic features of the state: the Marble Valleys and the Trap Rock (Basalt) Ridges. A unique and fascinating feature of this book consists of loose copies of the maps described above, printed in color on translucent material and stored in a pocket inside the back cover. These maps are drawn to the same scale as the distribution maps accompanying each individual species account. The transparencies can be overlain on the species distribution map to ascertain whether a correlation exists between any given species' distribution and elevation, the marble valleys, and/or the trap rock ridges. In some cases the correlation is almost 100% and seeing it graphically is far more impressive than just reading about it in the text.

I would recommend this book heartily to anyone interested in the natural history of the southern New England area. It is particularly useful in pinpointing the regional distribution of the individual species and in describing their habitats, but it also contains excellent accounts of their behavior, reproduction, and ecological requirements.

—*Don Riemer*

This review was originally printed in the Fall, 1993 Issue of "NYTTS NewsNotes" of the New York Turtle and Tortoise Society.

This book is not sold in bookstores. apart from the book's publisher (the State of Connecticut Department of Environmental Protection), NYTTS is the book's only distributor.

To order a copy, send a $45.00 check or money order payable to NYTTS, to: NYTTS Mail Order, PO Box 878, Orange, NJ 07051-0878.

Received: 16 March 1994

NOTES:

SMITHSONIAN RESEARCH FELLOWSHIPS IN HISTORY, ART, AND SCIENCE

The Smithsonian Institution announces its research fellowships for 1995 in the fields of History of Science and Technology, Social and Cultural History, History of Art, Anthropology, Biological Sciences, Earth Sciences, and Materials Analysis.

Smithsonian Fellowships are awarded to support independent research in residence at the Smithsonian in association with the research staff and using the Institution's resources. Under this program, senior fellowships of three to twelve months, predoctoral and postdoctoral fellowships of three to twelve months, and graduate student fellowships of ten weeks are awarded. Proposals for research in the following areas may be made:

History of Science and Technology: History of agriculture; air and space; computers, communication, and society; electrical technology; engineering; industrial archaeology; mathematics; medicine and pharmacy; natural history; physical sciences; social dimensions of science and technology; and transportation.

Social and Cultural History: American business history; American folklore; American political, military, social, and cultural history; history of money and medallic art; history of music and musical instruments; and material aspects of American everyday life.

History of Art: African art; American art of the 18th, 19th, and 20th centuries; decorative arts; modern art; Asian and Near Eastern art; and twentieth-century American crafts.

Anthropology: Archaeology; cultural anthropology; folklife; linguistics; and physical anthropology.

Biological Sciences: Animal behavior and pathology; ecology; environmental studies; evolutionary biology; marine biology; natural history; paleobiology; systematics; and tropical biology.

Earth Sciences: Meteoritics; mineralogy; paleobiology; petrology; planetary geology; sedimentology; and volcanology.

Materials Analysis: Archaeometry and conservation science.

Deadline: January 15, 1995.

Postdoctoral Fellowships are offered to scholars who have held the degree or equivalent for less than seven years. **Senior Fellowships** are offered to scholars who have held the degree or equivalent for seven years or more. The term is 3 to 12 months. Both fellowships offer a stipend of $25,000 per year plus allowances.

Predoctoral Fellowships are offered to doctoral candidates who have completed preliminary course work and examinations. The term is 3 to 12 months. The stipend is $14,000 per year plus allowances.

*Predoctoral, postdoctoral, and senior stipends are prorated for periods of less than twelve months.

Graduate Student Fellowships are offered to students to conduct research in association with research staff members of the Smithsonian. Students must be formally enrolled in a graduate program of study, have completed at least one semester, and not yet have been advanced to candidacy if in a Ph.D. Program. The term is 10 weeks; the stipend is $3,000.

Awards are based on merit. Smithsonian fellowships are open to all qualified individuals without reference to race, color, religion, sex, national origin, age, or condition of handicap of any applicant.

For more information and application forms, please write: Smithsonian Institution, Office of Fellowships and Grants, 955 L'Enfant Plaza, Suite 7000, Washington, D.C. 20560, or e-mail: siofg@sivm.si.edu. Please indicate the particular area in which you propose to conduct research and give the dates of degrees received or expected.

SMITHSONIAN MINORITY INTERNSHIP PROGRAM

Internships, offered through the Office of Fellowships and Grants, are available for students to participate in research and museum-related activities for periods of nine to twelve weeks during the summer, fall, and spring. U.S. minority undergraduate and graduate students are invited to apply. The appointment carries a stipend of $250 per week for undergraduate and $300 per week for graduate students, and may provide a travel allowance.
Deadlines:
For Summer (to begin after June 1): February 15
For Fall (to begin after September 1): June 15
For Spring (to begin after January 1): October 15

For applications and/or information, please write: Smithsonian Institution, Office of Fellowships and Grants, 955 L'Enfant Plaza, Suite 7000, Washington, D.C. 20560, or e-mail: siofg@sivm.si.edu.

A New Book from the Society for the Study of Amphibians and Reptiles

CAPTIVE MANAGEMENT AND CONSERVATION OF AMPHIBIANS AND REPTILES

Edited by James B. Murphy, Kraig Adler & Joseph T. Collins • Foreword by Gerald Durrell

This new book (written by 70 leading authorities from throughout the world representing universities, museums, conservation organizations, zoos, aquariums, and the private sector) is a current review of techniques for managing and breeding animals in captivity for purposes of conservation. The emphasis is on endangered species, special and new techniques, and on diagnosing problems, yet the coverage is comprehensive and includes a broad array of issues.

• General Issues

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The Roles of Zoos and Aquariums

• Reproduction and Management

Nutrition of Carnivorous Reptiles
Nutrition of Herbivorous Reptiles
Effects of Temperature
Light Requirements
Veterinary Procedures for Acquisition and Release
The Physical Environment for Incubation of Reptilian Eggs
Conservation and Management of Tortoises
Chemoreception in the Feeding Behavior of Reptiles
Captive Maintenance and Lineage Senescence
Conservation of Commercially Important Reptiles
Reproductive Strategies and Conservation of Tropical Frogs
Control of Amphibian Reproduction
Reproductive Patterns of Amphibians and Reptiles
Implications of Phenotypic Plasticity
Assessing Genetic Variation in Captive and Natural Populations
Inducing Reproduction in Reptiles
Ethological Approaches to Reproductive Success
Experimental Manipulations of Clutch Size and Offspring Size

• Model Programs

Separate chapters focus on particularly successful programs. These cover salamanders, caecilians, dendrobatid frogs, hylid frogs, bufonid toads, mud turtles, Galapagos reptiles, iguanid lizards, day geckos, Old World chameleons, prehensile-tailed skinks, boid snakes, colubrid snakes, rattlesnakes, crocodilians, and tuataras.

• Future Directions

Role of the Private Sector
Future Research at Academic Institutions
Zoo Programs for Management, Breeding, and Conservation

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8 August, 1994

Maryland Herpetological Society
Natural History Society of Maryland
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Maryland 21218, USA

Dear members of the Maryland Herpetological Society,

The Centre for Endangered Reptiles needs your help. We need to expand our conservation programs and are seeking donors who believe as we do that endangered reptiles and amphibians are worth saving.

The Centre is a Canadian registered charitable organization with a 20-year history of conservation work. We are accredited as a research institution by the American Zoo Association, and are supported largely by our donors. We exist to fight for the survival of endangered species by finding new ways to protect and restore their populations. We are making progress towards that important goal. In the past year our small organization has been able to:

- ➡ assemble the conservation breeding data-base, or studbook, for the highly endangered Jamaican boa, and we are helping to assemble the studbook for the African Spurred Tortoise
- ➡ build a new enclosure for our endangered Bengal monitors, where the females laid eggs in October
- ➡ breed some of our endangered Cuban boas, perhaps over 30 years old, for the first time
- ➡ repatriate over 100 turtles confiscated from an illegal pet shipment
- ➡ collaborate with university researchers to develop new genetic paternity tests for endangered reptiles
- ➡ study natural turtle populations to design better reintroduction programs

Despite these successes, they are not enough to tip the balance in favour of survival for endangered species. Although we have access to the most modern tools available to conservation, those tools are useless if we haven't got the resources to apply them.

Our colleagues at university labs, for example, are working on genetic fingerprinting, which is revealing the breeding patterns of turtles and will help us to breed endangered snakes more successfully. However, DNA research is not going to resurrect species if we fail to save them right now. Don't be fooled by Hollywood special effects:

If we loose a species now, it's extinct forever.

continued...

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We need to tackle fundamental problems in captive breeding, biology and genetics, we must forge better liaisons with institutions such as the Bronx Zoo and Fort Worth Zoo, and we must improve our lines of communication to the scientific community and the wider world. We need to participate in meetings of conservation specialists throughout North America, to build relationships and exchange ideas, and expand our ability to communicate our results. All of these require more resources than we have right now.

In the fight for ecological balance and survival, reptiles and amphibians too often loose the battle. We cannot carry on with our part of the fight unless we are able to increase our support for the coming year.

Over the next months we need to raise an additional $50,000 to meet our immediate conservation goals. We are now approaching donors, conservation organizations, charitable foundations, and others to help us meet our objective. We would be very grateful if your organization would consider making a donation of $100 toward the expansion of our conservation programs. If a cash donation is not possible, please think about other ways in which you might be able to help us, such as holding a fund-raising event.

I've also enclosed recent copies of our newsletter, **Scales and Tales**, and membership applications and return envelopes, should anyone be interested in joining the Centre. We welcome participation and membership by all. We have members in the U.S.A., Canada, England ... even in Argentina. Please make our membership materials available to anyone who might like to join.

Get in touch with the Centre for Endangered Reptiles today. We would be happy to provide you with any other information that you might require. Your help is crucial in the fight to prevent extinction!

with best wishes,

David A. Galbraith

David A. Galbraith, Ph.D.
Executive Director/Curator

PS. Real turtles don't eat pizza -- and real research does not come cheap. It costs $50 for a DNA fingerprint to determine paternity for a reptile, $200 to buy a transmitter for research on turtle ecology, and at least $400 per year to provide care for each snake at the Centre. Help us find the answers. The reptiles can't wait for a Hollywood fantasy to come true... their survival depends on real progress today.

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BULLETIN OF THE

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DEPARTMENT OF HERPETOLOGY

THE NATURAL HISTORY SOCIETY OF MARYLAND, INC.

MDHS...........A FOUNDER MEMBER OF THE
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The third Wednesday of each month, 8:15 p.m. at the Natural History Society of Maryland (except May—August, third Saturday of each month, 8:00 a.m.). The Department of Herpetology meets informally on all other Wednesday evenings at the NHSM at 8:00 p.m.

THE DISTRIBUTION OF THE PRAIRIE RATTLESNAKE (*CROTALUS V. VIRIDIS*) IN MEXICO

Julio Alberto Lemos Espinal, David Chiszar and Hobart M. Smith

A seventh precise locality is recorded for *Crotalus v. viridis* about 32 km southwest of the nearest previous record, and near the southern edge of the sand dunes habitat of north-central Chihuahua, where the range of the species probably terminates in that region. Known locality records for Mexico are mapped and errors in the literature corrected.

Surprisingly few records exist for *Crotalus v. viridis* (Rafinesque) in Mexico. Six precise localities are known for the states of Sonora (1), Chihuahua (3), and Coahuila (2). A seventh locality of capture is therefore of special interest. On Oct. 3, 1993, a single adult female (HMS field no. 36263, deposited in the Colección Herpetológica del Proyecto Conservación y Mejoramiento del Ambiente (CyMA) of the Escuela Nacional de Estudios Profesionales Iztacala of the Universidad Nacional Autónoma de México, Mexico) was found by the authors insolating in midmorning on a primitive, single-track road through extensive, semi-stabilized sand dunes 2.1 km W Rancho El Gato in north-central Chihuahua. The ranch is 22.5 km S Samalayuca via Mexico highway 45, thence 5 km W.

The specimen, 652 mm total length, tail 32 mm, is essentially typical of its subspecies, its characteristics falling within known ranges of variation, although some are marginal. There are only 34 body blotches (33-57, mean 43.7) in the subspecies as a whole, fide Klauber, 1972: table 2:7, although Mexican specimens only have but 32-51, mean 40.5, fide Klauber, 1952: table 1). The specimen also has most body blotches "indented fore and aft," as Klauber (1952:103) noted is often true of Mexican material. The rear seven body blotches are not light-bordered, the preceding one only faintly so, and all others are distinctly light-bordered, the rear eight of which are indented so strongly as nearly to split the blotches into two. Other features are normal: prenasals contacting rostral; four internasals; minimum of three scales between supraoculars; anterior subocular widely separated from all supralabials; latter 14-14; infralabials 15-15; ventrals 181; subcaudals 19; midbody scale rows 25; central caudal scale rows 14; rattle of five segments, only button missing; width of basal rattle segment (11 mm) more than 2.5

times in head length (30 mm); ventrals unpigmented except at extreme lateral edges; eight caudal rings, none black.

The localities here cited (Fig. 1) require some explanation. Not included is a locality first cited by Klauber (1930: 131) about 10 mi S Sonora-Arizona border, 20 mi SE Sasabe, Pima Co., Arizona, for *C. v. cerberus* (Coues). Klauber later (1949: 89-90) rejected the locality data as unreliable; his notes on the specimens in 1930 suggest that they represent at least two subspecies: *C. v. helleri* Meek, which is limited to southern California and Baja California Norte (Klauber, 1972: fig. 2:6), and *C. v. cerberus*, now recognized only in Arizona and New Mexico. The specimens in question do not represent *C. v. viridus*, and their locality data cannot be trusted regardless of subspecies represented.

Confusion has also beset the easternmost known locality for Coahuila. Schmidt and Owens (1944: 114) first and correctly reported *C. v. viridis* from Allende on the basis of a headless specimen acquired by Ernest G. Marsh, Jr., as part of a collection centered upon and taken within a radius of 100-200 air km of Múzquiz. Before that report was published, however, the checklist and key to Mexican snakes (Smith and Taylor, 1945) was completed in manuscript form, and through the kindness of K. P. Schmidt the presence of a specimen of *C. v. viridis* in Marsh's "Múzquiz" collection was confided to Smith, but without specific indication of locality. Hence Múzquiz was listed for the species in Smith and Taylor (1945: 197), and this was later repeated by Klauber (1952: 103). The record for Múzquiz is in error and a lapsus for Allende, some 82 air km NE Múzquiz.

For unknown reasons, Klauber's 1956 and 1972 maps did not depict the range of *C. v. viridis* extending to either the Allende or Múzquiz area, leading to the same omission by Stebbins (1985), Campbell and Lamar (1989) and Conant and Collins (1991). On the other hand, although neither edition of Klauber's monograph shows the easily confused species *C. scutulatus* (Kennicott) ranging into the Múzquiz/Allende area, Stebbins (1985), Campbell and Lamar (1989) and Conant and Collins (1991) do. Since size and number of anterior head scales are the "key" characters distinguishing *C. viridis* from *C. scutulatus*, and the head is missing from the Allende specimen, confirmation of the identity of the Allende specimen was sought on the basis of the distinctions (Klauber, 1930: 119, 121) between the two species in number of tail rings (*C. scutulatus* females 3-5, males 4-7, *C. viridis* 7-9 and 9-12 respectively) and their color (all or part black in *C. scutulatus*, none black in *C. viridis*). Alan Resetar kindly examined the specimen for us, reporting (pers. comm.) that it has eleven tail rings, all of the same color as the body blothces. Therefore no question remains that it is a male *C. v. viridis*, whose range should be regarded as extending at least to the vicinity of Allende in northeastern Coahuila (Fig. 1).

Still another lapsus is involved in a record for Chihuahua in Klauber (1952: 103), where a locality is cited "6 miles west of the Sonora line on the road from Bavìspe (Sonora) to Casas Grandes;" that description obviously would put the locality in Sonora, not Chihuahua. The correct data are cited by Tanner (1985: 665); "16 mi E of Chihuahua-Sonora border on the Bavispe to Nuevo Casas Grandes Road."

The only other precise western Mexican records for *C. v. viridis* are El Espía (Amaral, 1929: 89) and 2 mi E Samalayuca (expressed as "the dunes near Samalayuca" by Campbell and Lamar, 1989: 371), Chihuahua, and San Bernardino, Sonora (Klauber, 1952: 103). Klauber (loc. cit.) stated that he had seen nine specimens from Mexico, but some (presumably four) of indefinite locality; they no doubt included the three from "Sonora" listed by Amaral (1929: 89).

Although both editions of Klauber's monograph indicated extension of the range of *C. v. viridis* into northwestern Coahuila opposite the Big Bend of the Rio Grande, the only record of which we are aware justifying that extension at that time was in Taylor et al. (1947), where a "*Crotalus* sp." is recorded as having been observed, but not collected, somewhere on the expedition's route (see map, Taylor et al., 1946) exploring northern Sierra del Carmen. Unlike the case for the other species of amphibians and reptiles reported, no precise locality was given for the sight record. Klauber's map served as a model for the maps in Stebbins (1985), Campbell and Lamar (1989: 370), and Conant and Collins (1991), but a precise record for the vicinity was ultimately provided by Liner et al. (1977: 49) for Rancho El Tule, on the southern flank of the Serranias del Burro.

The specimen here reported for the first time probably came from very near the southern limit in that area of the range of the species, which limit we conjecture coincides with the southern edge of the vast area of sand dunes, some live but most semi-stabilized, that extends from southeastern New Mexico as far south as 31° 08′ N, at the latitude of 21.5 airline km S Samalayuca. It is of interest that Reynolds' (1982) large collection from an 80.5 km stretch of highway just NW of Cd.

Chihuahua included no *C. v. viridis,* although 104 *C. scutulatus* (Kennicott), 79 *C. atrox* Baird and Girard, 20 *C. molossus* Baird and Girard and 3 *C. lepidus* (Kennicott) were taken. Similarly, Tanner (1985: 665) noted the rarity of the species because the extensive field work of his group "south of Ciudad Juárez, Las Palomas and Antelope Wells (across the border south of Lordsburg) has not provided a specimen of *viridis.*"

Acknowledgments

We are much indebted to Dr. Fermin Rivera Agüero of CyMA-UNAM Iztacala for logistic support; to Dr. Ezequiel Ezcurra for our collecting permit A00702.-05929 from the Instituto Nacional de Ecologia-SEDESOL; and to Alan Resetar for verifying the identity of the Allende specimen in FMNH as *C. v. viridis.*

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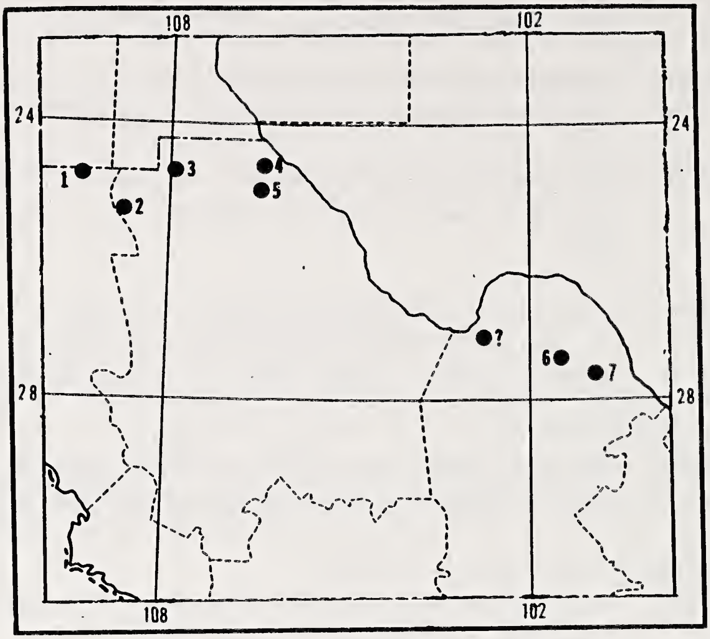

Fig. 1. Localities of record for C. *v. viridis* in Mexico. 1, San Bernardino, Sonora. 2, 16 km E chihuahua-Sonora border on the Bavispe (Sonora) to Nuevo Casas Grandes road. 3, El Espia, Chihuahua. 4, 2 mi E Samalayuca, Chihuahua. 5, 2.1 km W Rancho El Gato, Chihuahua. 6, Rancho El Tule, Coahuila. 7, Allende, coahuila. ?, Possible sight record near or in northern Sierra del Carmen.

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STRIKE-INDUCED CHEMOSENSORY SEARCHING IN EASTERN GREEN MAMBAS (*DENDROASPIS ANGUSTICEPS*)

David Chiszar, Douglas Mehaffey, Frederick Antonio and Hobart M. Smith

Juvenile and adult eastern green mambas (*Dendroaspis angusticeps*) were observed at the Central Florida Zoological Park. Rodent prey were released after envenomating strikes, with adult snakes releasing immediately while juveniles did so after a brief (1-2 sec) delay. High rates of tongue flicking as well as other searching behaviors were seen after strikes, and the adult snakes exhibited much stronger responses than did the juveniles. We conclude that strike-induced chemosensory searching is a well-developed, standard aspect of predatory behavior in adults of this species, less so in juveniles who probably are exclusively arboreal and take different prey than do the adults.

It is well known that rattlesnakes and many (but not all) other vipers typically release adult rodent prey immediately after the predatory strike (Kardong, 1986). A few minutes later the snakes exhibit an elevated rate of tongue flicking, called strike-induced chemosensory searching (SICS), that facilitates tracking the post-envenomation trail deposited as the prey wander from the site of attack (Golan et al., 1982; see Chiszar et al., 1992 for a review). Cobras also exhibit SICS and trail-following behavior (Chiszar et al., 1983), but these snakes tend to hold rodent prey after striking them, releasing only when the prey exhibit retaliatory behaviors such as biting or scratching (Kardong, 1982). On the other hand, some elapid snakes, such as taipans (*Oxyuranus scutellatus*), are known to release adult rodents immediately after the strike, much as rattlesnakes do; and this behavior has been interpreted as reflecting a significant degree of specialization on rodents (Shine & Covacevich, 1983). Mambas have also been observed to behave this way (R. H. Hunt, personal communication), and the present study provides confirmatory data as well as evidence on the occurrence of SICS.

Methods

Subjects were 10 green mambas (*Dendroaspis angusticeps*) in the collection of the Central Florida Zoological Park, Lake Monroe, Florida. All snakes were individually housed in glass terraria, maintained on a 9.5 L-14.5 D photoperiod, with temperature varying from 74° F - 78° F at the time of observation (29 Dec. 1992). Three snakes were adults (168-180 cm total length) and seven were juveniles (33-41 cm total length), hatched at the Central Florida Zoological Park (29 May 1992). Terrarium dimensions were 20 x 40 x 26 cm for juveniles and 46 x 51 x 91 cm for two adults. The third adult, the only specimen on exhibit at the time of this study, was in a much larger enclosure (101 x 114 x 91 cm). All animals had been feeding biweekly on rodent prey, and had been deprived of food for two weeks prior to the present study. Hence, our observations were made on a regularly scheduled feeding day.

All trials began with a 10 min baseline period, during which we recorded the number of tongue flicks occurring while snakes were undisturbed, except for the observer's presence about 50 cm from the cage. Three snakes, all juveniles, then received a 3-5 sec presentation of a live prey item (neonatal rat), suspended into the snakes cage by tongs and held just out of striking range, about 15 cm from the snake's snout. Tongue flicks were again recorded for 10 min starting immediately after the prey was removed. The remaining seven snakes received a 3-5 sec presentation as above, but then the prey was moved within striking range. All snakes struck and released, the prey was removed, and tongue flicks were recorded for the next 10 min.

Results

The mean rate of tongue flicking during all baseline periods was 0.8 per min, indicating that snakes were quiescent prior to introduction of prey. Rates of tongue flicking after presentation of prey are shown in Table 1, where it can be seen that no-strike presentations resulted in only a slight and nonsignificant increase over the baseline rate ($t = 2.00$, $df = 2$, $p > 0.05$). Both adult and juvenile groups of snakes that struck prey, however, showed significantly elevated rates of tongue flicking relative to their baselines (juveniles: $t = 3.30$, $df = 3$, $p < 0.05$; adults: $t = 5.62$, $df = 2$, $p < 0.05$). Furthermore, both of these groups exhibited significantly higher rates of tongue flicking than did the no-strike group (juveniles: $t = 2.60$, $df = 5$, $p < 0.05$; adults: $t = 4.06$, $df = 4$, $p < 0.05$).

Of additional interest is the comparison of the two strike groups. Juveniles had significantly lower post-strike rates of tongue flicking than did adults ($t = 3.94$, $df = 5$, $p < 0.05$). Indeed, the rates seen in the adults were comparable to the highest levels of SICS seen in rattlesnakes, whereas the rates seen in the juveniles were modest. This is consistent with statistical tests reported in the previous paragraph showing that the post-strike performance of adult mambas was robustly higher than that of the no-strike group, whereas the post-strike performance of the juveniles was just barely significant in the same comparison.

Discussion

Because the juveniles were only marginally responsive to NS and S conditions, it is problematic to use their NS performance as an estimate of the NS performance of adult mambas. Fortunately, an alternative is available from previous SICS studies with adult elapid snakes, including red spitting cobras (*Naja pallida*), Indian cobras (*Naja naja*), tiger snakes (*Notechis scuttatus*), and taipans (*Oxyuranus scutellatus*) (Chiszar et al., 1983; O'Connell et al., 1985; Radcliffe et al., 1986; see also Kardong, 1982). Procedures in all of these SICS studies were comparable to those used here. All NS performances were higher than that shown for juvenile mambas in Table 1. Nevertheless, when the NS rates of tongue flicking are averaged across all of the previous studies, the values shown in row 3 of Table 1 are about three fold higher. Accordingly, three conclusions seem to be justified from the present study. First, eastern green mambas, in spite of the profound toxicity of their venom, routinely release rodents after the predatory strike. This was equally true for juvenile and adult snakes, although the latter released rodents immediately whereas most of the juveniles did so after 1-2 sec. Second, SICS is a reliable component of post-strike behavior. Third, SICS is far more robust in adult green mambas than in juveniles.

Following Shine and Covacevich (1983), we interpret the immediate release of rodent prey and the occurrence of SICS to indicate an evolutionary history of dependence upon such prey. The hypothesis that underlies this idea is that holding rodents in the jaws following a strike is risky because retaliatory behavior involving biting and scratching can result in injury to snake skin as well as to sensory receptors located in the facial area. Other prey (e.g., amphibians, lizards, eggs, etc.) do not pose such problems. Rodents, however, must be forcibly restrained from retaliation, as when constrictors wrap coils around them; or, the predators sometimes possess protective devices (Chiszar & Radcliffe, 1989; Chiszar et al., 1989). Releasing the prey after an envenomating strike is an analogue to the protective anatomical features seen in some pit vipers. This behavior minimizes the snake's risk of injury, but it requires relocating the prey after it has wandered off and succumbed to venom. Hence, it is not surprising to find SICS occurring in mambas since they release rodents after the strike.

These findings articulate with available field data on green mambas. Although some authors describe green mambas as exclusively arboreal (Curran & Kauffeld, 1937; Isemonger, 1962), other writers consider this to be true only for juveniles, noting that adults frequently are found on the ground hunting for rodents (Ditmars, 1937). Starin and Burghardt (1992) observed adult western green mambas (*Dendroaspis viridis*) moving from the ground into trees and vice versa in the Gambia. Consequently, we postulate that juvenile and adult green mambas rely upon different foods and use different predatory techniques, with the young preying upon small arboreal items, which are probably held after the strike, and with SICS and trail-following skills developing as the snakes attain larger size and an orientation to terrestrial rodent prey.

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Table 1. Mean rates of tongue flicking (per min) by green mambas in each experimental condition.

	Minutes									
	1	2	3	4	5	6	7	8	9	10
No-strike (n=3)	2.3	1.6	0	0	0	0	0	0	0	0
Strike (juveniles; n=4)	10.0	9.3	6.8	1.3	1.8	0	2.3	0.3	4.3	0
Strike (adults; n=3)	39.3	41.3	46.6	54.6	65.0	55.0	58.0	62.6	49.0	62.3

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RESULTS AND THEIR BIOLOGICAL SIGNIFICANCE OF A FALL HERPETOLOGICAL SURVEY OF THE TRANSMONTANE SAND DUNES OF NORTHERN CHIHUAHUA, MEXICO

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For seven days, Sept. 28 through Oct. 4, 1993, the authors attempted a survey of the herpetofauna of the enormous sand dune area (Fig. 1) of northern central Chihuahua - an area here termed the "transmontane sand dunes" in reference to its position on the windward (southern and western) sides of the Samalayuca, El Presidio and associated mountain ranges. The dunes nearest the cited mountain ranges are active, largely barren, as much as 50 m in height, and prominently visible as they stretch for many km parallel to both ranges of mountains. In the rest of the area the dunes are semi-stabilized, but retain their highly irregular contours and often sparse vegetation. In most areas a caliche bedrock is very deep, over 6 m, although peripherally it is shallow (1-2 m). The southern and western borders are marked by a distinct escarpment 10-20 m in height.

The dune area is sparsely populated, with ranch dwellings 5-10 or more km apart. Little or no cultivation exists; the land is devoted primarily to cattle, and ranches are mostly very large, of several square km. Roads are primitive, single-track trails for the most part; only one paved, two-lane highway (Mexico 2) traverses the area east to west, only 10-17 km south of the U. S. border and west of Cd. Juárez, and a four-lane, divided highway (Mexico 45) crosses a narrow neck of the dunes (see Fig. 1) north to south. Our work was restricted to the dunes area south of the vicinity of Mexico 2, mostly west of Mexico 45, but in part east, as far as access was available to the Presidio dunes.

No rain fell during our stay, but a very heavy rainstorm had preceded us by a month (30 mm 31 August, following upon an additional 42.3 mm earlier in the month, and augmented by 5 mm more 24-25 September), so saturating the soil that the roads remained under water in many places, often requiring short but sometimes extremely rough detours around pools in the road. Except for the roads and permanent ponds, the soil in the dunes area was dry where exposed, although moisture persisted under surface debris. The soil west of the dunes, being less permeable, remained shallowly covered with water over vast areas and thereby created difficult driving.

Only eleven species were recorded by us in the dunes area, and of those one (*Masticophis taeniatus girardi*) was observed but not captured (not through lack of effort), and one (*Masticophis flagellum taeniatus*) was represented solely by fragments of a shed skin. A twelfth species (*Pituophis melanoleucus affinis*) was represented by a DOR specimen taken south of Nuevo Casas Grandes on our return trip.

Inasmuch as we were reduced to capture of specimens by hand or rubber band, we saw many individuals that could not be apprehended, although only one (of a large species of *Sceloporus*) appeared to be of a species not among those we did record. Thus the variety of herps secured was little affected, but the number was greatly limited (only 83, excluding 46 tadpoles and 6 transformlings of *Spea bombifrons*).

The small numbers of specimens collected can be attributed in part to inadequate collecting equipment (guns were not permitted), and in part to the lateness of the season, but the limited variety was a product almost exclusively of the latter factor, in turn related to temperature. Daytime temperatures were regularly in the 30's C. (90's F.), certainly adequate for herpetozoan activity, but the nighttime temperatures regularly dropped to the teens C. (50's F.), far too low for heat-adapted herpetozoans, although such temperatures would have little affected temperate-adapted species, as DC and HMS have observed over many years in Colorado.

Furthermore, it may be observed that all of the species we encountered so late in the season have ranges extending at least as far north as about 43 degrees north latitude (on a par approximately with southern South Dakota), with the sole exception of *C. inornatus*, reaching only to about 36 degrees north latitude (on a par with northern Arizona). None of the many other more southern taxa known to occur in northern Chihuahua were found, and only one specimen of that one exception was captured.

Through our brief experience in the late season of a region subjected to torrid heat much of the year (and to which the local herpetofauna is adapted), as compared with our lengthy experience in a temperate region (Colorado), it became readily apparent that, for the most part, species adapted in at least a major part of their range to temperate climatic conditions are likely to remain active later in the season under subtropical or tropical conditions than those species occurring mostly or entirely under the latter conditions. We can also confirm the generally accepted hypothesis that juveniles are more tolerant of, and active in, low temperature regimes than adults; most of the lizards we found, except for *Sceloporus undulatus*, were juveniles.

Acknowledgments

We are much indebted to several ranchers of the dunes area for the privilege of collecting and camping on their property, especially to Pablo Castro and his family, of Rancho La Laguna, on whose Nuevo Rancho Alegre we stayed for five days; to Drs. Fermin Rivera Agüero of CyMA-UNAM Iztacala, Michael C. Grant, William M. Lewis and Shi-Kuei Wu of the University of Colorado for logistic support; and to Dr. Ezequiel Ezcurra for our collecting permit A00702.-05929 from the Instituto Nacional de Ecología-SEDESOL.

Species Accounts

All specimens designated by ENEPI (supplemented by HMS field numbers) are now in the Colección Herpetológico del Proyecto Conservación y Mejoramiento del Ambiente (CyMA) of the Escuela Nacional de Estudios Profesionales Iztacala of the Universidad Nacional Autónoma de México (UNAM), Mexico. Those designated by MZFC (supplemented by HMS field numbers) are in the Museo de Zoología, Facultad de Ciencias, UNAM. All of the remainder are in the University of Colorado Museum (UCM). We have also noted all specimens in the UCM collection from Chihuahua of the 12 taxa we obtained, as well as a few in other collections that are pertinent to the particular problems discussed.

Spea bombifrons (Cope)

Although many temporary pools of rainwater remained from the very heavy rainstorm of 31 August, we saw tadpoles only in one, in the road 6.5 km E El Sancho, Sept. 28. At that time 46 tadpoles, all near transformation, were captured. The largest measured 63 mm in total length, head-body length 29 mm, maximum body width 19 mm. None had developed forelegs. However, on Sept. 30, a number of partially transformed individuals, with functional forelegs and reduced tail, were observed hopping about near the margins of the same pool; five were collected at that time. They had thus taken about 30 days to transform sufficiently to emerge from the water, assuming that breeding occurred on the night of 31 August. That time-span is much longer than usual for the species, but possibly the cool weather was a factor in retarding development. Of the whole lot of 51, 18 (including two transformlings) are in ENEPI, 13 (including one transformling) in MZFC (6404), the remaining 19 (including two transformlings) in UCM (56851-2, 56862).

A fully transformed juvenile (UCM 56852), without tail, 28 mm s-v, was found hopping among the sand dunes, out of sight of water, on Sept. 29, at El Congelado, by Julio Lemos.

None of the tadpoles were cannibalistic; their orbitohyoid muscles (Pfennig, 1992: 1409) are small, the intestine lengthy and narrow, and none possess a distinct beak on the upper mandible, or a notch on the lower. Four possess a very weak beak on the upper mandible, but no evidence whatever of a notch on the lower. The denticles are regularly in four rows on each labium.

The records for species of this genus in Chihuahua cited by Tanner (1989) suggest that the ranges of *S. bombifrons* and members of the *S. hammondi* complex are depicted in Stebbins (1985) and Conant and Collins (1991) too extensive in the northern part of the state, the former too far west, the latter too far east.

The UCM has no other specimens of the species from Chihuahua, although a large series (20788-20858) of adults of the *S. hammondi* complex is present from 3 mi S Madera.

Terrapene ornata luteola Smith and Ramsey

A large adult male, 131 mm plastral length, ENEPI (HMS 36224), with 10-11 growth rings on the pleural scutes, was taken basking in mid-morning sunshine, Oct. 1, among sand dunes at Nuevo Rancho Alegre. Although the locality is near the southern range limits of the species and subspecies, several other records (Iverson, 1992: 203) are known along the Cd. Juárez-Chihuahua highway as far south as the vicinity of Cd. Chihuahua. North of the approximate latitude of Nuevo Rancho Alegre, the subspecies ranges farther west, into northeastern Sonora.

The specimen is typical of young adults of the subspecies, having a distinct pattern on both carapace and plastron, 12 yellow streaks near the edge of each second pleural scute, anterior lobe of plastron 71% of the posterior lobe, intergular seam length 51% and interpectoral seam length 33% of anterior lobe length; all these character-states fall within known range limits, although only the number of pleural streaks falls outside the range of variation in *T. o. ornata* (Ward, 1978: 2).

UCM contains two adult female specimens of the subspecies, one (49579) from 9 mi N El Sauz turnoff from Hy 45, the other (49578) 31 mi N of the same turnoff. They have 13 and 19 yellow streaks respectively on the second pleural. These localities are very near the southern known range limit of the subspecies.

Cnemidophorus inornatus chihuahuae Wright and Lowe

A single adult male, ENEPI (HMS 36190), 56 mm s-v, was rubber-banded (by JALE) at a locality about 15 km NEE El Sancho (20 km S Samalayuca on Mexico Hy 45, thence about 25 rd km SWW on El Vergel Rd; 31° 10′ N, 106° 44′ W). It agrees almost perfectly with the illustration of the holotype male of this subspecies (Wright and Lowe, 1993: 138); no differences are evident. There are six prominent light stripes, and a faint, continuous, light vertebral stripe, the posterior half of which is visible only under fluid. The dorsal dark fields are gray-brown, the tail pale blue except at or near base, and the venter white. Scale counts are consistent with those given for the subspecies: scales around body (SAB, mean of several counts), 76; scales between paravertebral light lines (SPV), 8; ratio x 100, SPV/SAB, 10.5; femoral pores, total, 34; circumorbital scales, total, 9; interlabial scales, total, 22; lamellae on fourth toe, total, 58; primary preanal scales, 3.

Although Wright and Lowe (1993: 154) emphasize that the races they recognize are best identified by samples of several individuals, rather than single specimens, the only one available to us from our collection is so clearly referable to *C. i. chihuahuae* rather than the adjacent *C. i. heptagrammus* Axtell that we have no reservation in referring the population occurring at the site of its capture to the former subspecies in spite of the fact that the locality lies within the conjectured (Wright and Lowe, 1993: 134, map fig. 1) range of *C. i. heptagrammus*. We propose that the sample of the latter from Samalayuca, recorded by Wright and Lowe, was taken from near that town, which lies north of the extensive sand dunes that lie south, east and west of the Sierra Samalayuca, and that *C. i. chihuahuae* will be found throughout the sand dune area, as well as southward to the vicinity of Cd. Chihuahua.

The present record, therefore, of *C. i. chihuahuae*, extends the concept of its geographic range at least some 150 km from the northernmost locality cited by Wright and Lowe (1993: 138) - 9.3 mi S (by road) El Sueco. If the subspecies does indeed occur throughout the sand dune habitat of that region, it probably extends to or nearly to the New Mexico border west of Cd. Juárez, and southeastward along the length of the Sierra El Presidio, windward from its southwestward flanks.

UCM has 189 specimens of the species from Chihuahua. Of those, 99 are clearly referable to *C. i. chihuahuae* (12547-52, 50 mi N Cd. Chihuahua, Hy 45; 12553-65, 90 mi N Cd. Chihuahua; 22679-750, 36286-8, 18 mi S Gallegos; 37796-8, 15 mi S Cd. Chihuahua; 37799-800, 1.1 mi S Conchos). Three are clearly referable to *C. i. heptagrammus* (18723, Cd. Juárez; 37794-5, 83 km N Villa Ahumada, Hy 45). The remaining 87 are from the vicinity of Jiménez (49781-8, 7 mi N; 37801-3, 7 mi S; 37804-36, 37877-9, 12.5 mi S; 37837-40, 17.6 mi S; 37841-76, 20.1 mi S), and in pattern appear to be referable to *C. i. chihuahuae*, although Wright and Lowe (1993) referred a series of 12 from the Jiménez area with some question to *C. i. heptagrammus*, thereby greatly extending its range southward between those of *C. i. chihuahuae* and *C. i. paululus* Williams, from the Big Bend area of Texas and immediately adjacent Coahuila. An additional four in UCM from extreme northeastern Durango (37882-3, 9.6 mi N Bermejillo; 37880-1, 17.7 mi N Bermejillo) resemble the Jiménez series, not at all the nearby but more southern subspecies, *C. i. paululus*. Although we suspect that all of the Jiménez series should be referred to *C. i. chihuahuae* rather than *C. i. heptagrammus*, resolution of the problem requires more of a comparative study than we are prepared to undertake.

Cnemidophorus tigris marmoratus Baird and Girard

Two juvenile specimens were collected, both rubber-banded. One, ENEPI (HMS 36195), 50 mm s-v, was obtained (by JALE) 5.7 km E El Congelado, the same date, locality and habitat as the *Gambelia* (q.v.). The other (UCM 56861), 47 mm s-v, was secured (by DC) Sept. 30 on the plains (not sand dunes) at the west end of Cerro Los Muertos, 3.2 km W Rancho Los Muertos (the collecting site is at approximately 31° 7′ N, 106° 55′ W). Both localities are well within the range of the subspecies as extrapolated from Hendricks and Dixon (1986: 329, 370, figs. 1, 19), for example by Conant and Collins (1991: map 97), although Tanner (1987: 415) cites but six localities of record in northern Chihuahua, and none from the area we worked.

The data and arguments presented by Dessauer and Cole (1991: 635-636) leave no doubt that this subspecies is properly allocated to C. *tigris* Baird and Girard, not to a species of its own; no such thorough study had been made of the populations of these two taxa in contact with each other when Hendricks and Dixon (1986) elevated C. *t. marmoratus* to specific rank, with five subspecies.

The present specimens clearly represent C. *t. marmoratus* and not the nearest subspecies to the west (C. *t. gracilis* Baird and Girard), as made evident in comparison not only with Dessauer and Cole (1991) but also with Zweifel's (1962) comparative study of the two taxa.

Turning to the subspecies of Hendricks and Dixon's (1986) C. *marmoratus*, it is also clear that, as stated by them (pp. 372-373), three populational clusters are readily distinguishable by pattern and color. One cluster, containing only one subspecies (C. *t. pulcher* Williams et al.), thus presents no problem. Each of the other two clusters consists of two subspecies, as interpreted by Hendricks and Dixon. One contains C. *m. marmoratus* and C. *m. reticuloriens* Vance (1978), the other C. *m. variolosus* Cope and C. *m. nigroriens* Hendricks and Dixon. In neither cluster are the two subspecies distinguished by pattern or color - only by a combination of ten "higher" and/or "lower," selected scale characters. No figures are given that reveal percentages of separation by this combination of characters. Nevertheless, the authors' elegant multivariate statistical analyses not only established the significance of the differences between the members of each pair of subspecies, but they demonstrated that two weighted composite variables formed from the ten scale characters accounted for 64.3% of the total variation in these characters in 40 samples (1095 individuals) from most of the range of C. *marmoratus* (as they accepted the group of taxa involved).

Nevertheless, the criteria of valid subspecific distinctions are (1) practicality (of character-state determination) and (2) adequate degree of reliability (of individual assignment, to an at least 70% degree). There is no question that Hendricks and Dixon's analyses do indeed establish the reality of consistent differences between their C. *m. marmoratus* vs C. *m. reticuloriens*, and their C. *m. variolosus* vs C. *m. nigroriens*. Both those differences not only are difficult to arrive at (requiring an impractical, complex summation of analyses of populational variation in numerous (10) features), but also are not known to permit correct determination of a practically useful proportion of individuals. No key was given or statement made that any acceptable level of discrimination, other than by locality, is possible between the two taxonomic populations they recognized in their *C. marmoratus* and *C. variolosus* clusters. They observed (p. 373) that "No single feature of scutellation serves to separate an individual specimen into a subspecies or subspecies cluster although combinations of characters serve to identify local populations. Most individual specimens may be readily placed into the proper subspecies by observing the frequencies of scutal characteristics nearest the means for each character and group."

On the grounds stated, we here regard *C. t. reticuloriens* as taxonomically inseparable (even though statistically separable) from *C. t. marmoratus*, and *C. t. nigroriens* from *C. t. variolosus*. Statistically significant differences are not taxonomically significant where they fail to yield at least a 70% (and ideally a much stronger percentage) level of accuracy of allocation of individual representatives.

For the record, the scale counts for the present specimens are, respectively (using Hendricks and Dixon's 1986: 334-335 abbreviations): GAB, 95, 82; GIPBT, 148, 184; GMP, 54, 46; DL, 69, 62; ANCO, 4-4, 3-3; GBS, 29, 16; LSORS, 5, 4; LSOG, 81, 57; COS, 22, 18; FP, 48, 42.

The UCM has 72 specimens of *C. tigris* from Chihuahua, most of which were reported by Hendricks and Dixon (1986: 391,394), as either *C. m. marmoratus* or *C. m. reticuloriens*. Twenty-three others, all here referred to *C. t. marmoratus*, are from 24 mi S Cd. Juárez (22809-11), 43 km N Villa Ahumada (37946-56, 51893), 31 km N Villa Ahumada (37957-62, 51892, 51894), and 1.1 mi S Conchos (37997-8). All would be referable to *C. m. marmoratus* under the Hendricks/Dixon system except the last to *C. m. reticuloriens*.

Gambelia w. wislizenii (Baird and Girard)

A single juvenile male, ENEPI (HMS 36194), 59 mm s-v. was rubber-banded Sept. 29 (by JALE), 5.7 km E El Congelado (about 16 rd km NWN El Sancho; 31° 16′ N, 106° 53′ W), in a semi-stabilized sand dune area. The specimen has the typical juvenile pattern (Tanner and Banta, 1963: 133-134).

The species appears to be limited in Chihuahua to the northern quarter of the state; Tanner (1987: 389-390) did not find it south of El Sueco, and his southernmost record is 1 mi S Villa Ahumada. Few records are known even from that limited area; Tanner (op. cit.) lists only five, which bracket the present record. However, an isolated population occurs in northeastern Durango, which may extend into extreme southeastern Chihuahua. The UCM has two specimens from that population (but none from Chihuahua): 41409, 9.6 mi N Bermejillo, and 50008, 3.5 mi N Bermejillo, Durango.

Holbrookia maculata bunkeri Smith

Twelve specimens were taken: ENEPI (HMS 36191), El Sancho, Sept. 28, HMS; MZFC 6396, 5.8 km E El Congelado, Sept. 29, JALE; ENEPI (HMS 36250-2), MZFC 6399 (2), UCM 56871-3, near rest stop 11.2 km S Samalayuca, Hy 45 (km 307.65), Oct. 3, JALE, DC, HMS; UCM 56882, ENEPI (HMS 36272), 1.6 km N on road intersecting Hy 2 at 3.6 km E Microondas Duna, Oct. 4, DC. Another specimen examined is from 24 mi S Cd. Juárez (UCM 16322).

These specimens were compared with a series (25) of the similarly light-colored population, *H. m. ruthveni* Smith, of the White Sands near Alamagordo, New Mexico (UCM 32351, 41835-57, 43894), with 15 *H. m. approximans* Baird from various localities in New Mexico (all UCM: Bernalillo Co. [2 mi N Isleta Pueblo, 6134]; Catron Co. [nr Old Horse Springs, 34135-9; 1 mi S Horse Springs, 6135; Patterson's Lake, 3 mi W Horse Springs, 3136-7; 12 mi S Horse Springs, 3 mi E Bat Cave, 6138]; Grant Co. [22 mi NE Lordsburg, 24276]; Hidalgo Co. [10 mi N U.S.-Mexico border, E Hylo Peak, Hy 81, 32349]; San Juan Co. [34 mi SSE Bloomfield, 7270]; and Santa Fe Co. [9 mi S Santa Fe]), and with 30 *H. maculata* subsp. from central Chihuahua (all UCM: 50 mi N Cd. Chihuahua, Hy 45 [12785-6]; 90 mi N Cd. Chihuahua [12781]; 7 mi NE Escalón [16321]; 18 mi S Gallegos [16296-8, 16300-9, 16311-20]; 7 mi N Jiménez [49598]; 17.6 mi S Jiménez [41411]; and 20.1 mi S Jiménez [41412]).

The population here recognized as *H. m. bunkeri* ranges widely throughout the transmontane sane dunes to which that race appears to be limited. Its most conspicuous adaptation to those dunes (and character for recognition) is its light color, noted in the original description (Smith, 1935), and by Tanner (1987: 388) for a specimen from 30 mi S Cd. Juárez (undoubtedly in the sand dune area). All of the present series are readily distinguishable from the darker, brownish specimens from central Chihuahua, south of the dunes area, here listed. Tanner (loc. cit.) noted that three specimens from 4 mi E Nuevo Casas Grandes, west of the dunes area, are similar to his example from south of Cd. Juárez, having the same "basic color" and "diagonal belly spots" that are "faint and without any surrounding blue." However, females of *H. maculata* subsp. from Chihuahua listed above usually have a dim dorsal pattern, are almost unicolor, and have narrow, short, black lateral abdominal bars, greatly reduced in size; they thus do resemble female *H. m. bunkeri*, but their ground color is darker, brownish gray, rather than the whitish color of the latter subspecies. We surmise that the three from east of Nuevo Casas Grandes are such females.

The sand dunes race also differs from the other specimens here listed from Chihuahua in at least three ways. In the latter group, (1) 79% (n=29) have a minimum of one or two scales (internasals) in a row between the enlarged, circumnarial scales (presumably representing the divided nasal); (2) the tail is less than 50.0% of the total length of body and tail in 85% of males (20), 100% of females (9); and (3) the second supralabial is five times as long as wide, or more, in 13% (n=30). Respectively those figures for *H. m. bunkeri* (including the holotype and the one recorded by Tanner) are (1) 8%, (2) 0.0% in five each of males and females, and (3) 77% (n=13). The consistency of these four character-states (including the light color) over a large range of an essentially uniform habitat indicates that *H. m. bunkeri* is a distinct, valid subspecies.

Although the White Sands population (*H. m. ruthveni*) is similarly light-colored - even more so than *H. m. bunkeri* - it differs from the latter in at least two morphological features: (1) the tail is less than 50% of the total length in all males (14) and females (10) (0.0% in 10 *H. m. bunkeri*), and (2) the second supralabial is as much as five times (or more) as long as wide in only 8% (n=25) (77% in 13 *H. m. bunkeri*). Clearly the two taxa evolved independently, in at least some different ways, and are valid, distinct subspecies.

The samples from central Chihuahua here referred to *H. maculata* subsp. is indistinguishable, so far as we can determine, from *H. m. approximans*, except in one way: the minimum number of scales in any internasal row is one or two in 79% of the central Chihuahua specimens (n=29), only 7% of the New Mexico specimens (14). They perhaps represent a valid subspecies distinct from *H. m. approximans*, but in the present absence of supportive indicators the problem remains unresolved. It is further complicated by Tanner's (loc. cit.) report that his material from western Chihuahua (excluding the one from south of Cd. Juárez) had a tail-total length ration of 52-57% in males, whereas in our *H. maculata* subsp. no male had a ratio over 51% (43-51, n=10). Our females (40-47%, n=3) agree with his report (40-48%). Tanner's western Chihuahua males therefore disagree with Schmidt's (1922: 712) characterization of *H. m. approximans* as having a short tail in males (42-50%). Without a more inclusive study than we can undertake at the present time, the taxonomic significance of these variations cannot be resolved.

Sceloporus undulatus (Bosc and Daudin)

Thirty-one specimens were collected at various localities in the transmontane dunes area, and 52 others from the state of Chihuahua are in the UCM collection. They are at present under study are to be reported in detail elsewhere.

Uta stansburiana stejnegeri Schmidt

Thirty-three specimens were taken as follows: ENEPI (HMS 36189), 17.8 km E El Sancho, Sept. 28, JALE; UCM 56850, El Sancho, Sept. 28, HMS; ENEPI (HMS 36199-37203, 36205, 36207, 36220), MZFC 6400(7), UCM 56853-60, 5.8 km E El Congelado, Sept. 29, JALE, DC, HMS; ENEPI (HMS 36225), UCM 56863, Nuevo Rancho Alegre, Oct. 1, JALE; ENEPI (HMS 36241), same, Oct. 2, DC; UCM 56868, Luz Alva, Oct. 2, DC; ENEPI (HMS 36257), nr rest stop 11.2 km S Samalayuca, Hy 45 (km 307.65), Oct. 3, DC; ENEPI (HMS 36259), UCM 56874-5, 12 km SE Hy 45 on El Sabinoso rd, betw Sierra El Presidio and Los Médanos de El Presidio, at gate to Rancho Mal Querido, Oct. 3, JALE, DC; UCM 56883, 1.6 km N on rd intersecting Hy 2 at 3.6 km E Microondas Duna, Oct. 4, DC.

Although we observed this species to be abundant (the most abundant of all reptiles) throughout the transmontane dune area, Tanner (1987: 407-8) found it to be completely absent west of the Cd. Juárez-Chihuahua transect (and west of the dunes area). Both of the localities he cited are on that transect (nr Hy 45) and so are all of the 33 in the UCM from Chihuahua, including 12 from nr Hy 45 somewhere north of Delicias (41545-56), four from 28 mi S Cd. Chihuahua (9070-3), seven from 7.1 mi S Delicias (41561-7), one from 7 mi NE Escalón (16420), two from 24 mi S Cd. Juárez (16416, 16418), four from 0.6 mi N Moctezuma (41557-60), and three from 35 mi S Samalayuca (9067-9). Three others are from 17.7 mi N Bermejillo, Durango, in the northeastern corner of the state (41568-70). Too much of the northwestern part of the state is mapped by both Stebbins (1985) and Conant and Collins (1991) as part of the range of the species. The transmontane sand dunes probably constitute the limit of the range of the species westward in the north-central part of the state, although it may dip into the extreme northwestern corner.

Tanner (1987) conjectured that the absence of *Uta* in most of western Chihuahua may be due to competition with *Holbrookia maculata*. However, those two taxa occur sympatrically so extensively elsewhere that some other explanation seems to be involved.

UCM 41564-5 are hatchlings, 22 and 21 mm s-v respectively, and were taken June 15, 1966, 7 mi S Delicias. No other hatchlings are among the specimens here reported.

Masticophis flagellum lineatulus Smith

Parts of a shed skin, ENEPI (HMS 36236), of light color, no visible pattern, smooth scales and from a snake of moderate size, is assumed to represent this taxon. The largest ventrals represented are 25 mm in transverse (on the snake) direction, and lowermost dorsals are 6 x 6 mm in diameter. The skin was found 5.7 km E El Congelado, under debris among semi-stabilized sand dunes.

The species is well known in the general vicinity of the present record (Tanner, 1985: 636). The UCM has two specimens from Chihuahua: 12962, 52 km N Cd. Chihuahua, and 16050, 5 mi E Escalón.

Masticophis taeniatus girardi Stejneger and Barbour

A black racer about 60 cm in length, which we assume represents this taxon, was observed but not captured on Oct. 3. It was crossing a road through the sand dunes and hid in one of the numerous mammal burrows under a bush beside the road.

The species is well known in the vicinity of this sighting (Tanner, 1985: 637). UCM has no specimens of the subspecies from Chihuahua.

Pituophis melanoleucus affinis (Hallowell)

A large (144 cm total length, tail 19 cm) adult male, ENEPI (HMS 36274), was found DOR Oct. 6, at km 242.5 on Hy 65 about 3 km S San Buenaventura. It is typical of its subspecies, with reddish brown blotches on body, becoming black rings on tail. An additional key character separating it from *P. m. sayi* (Schlegel), as noted by Stull (1940: 24) and Klauber (1947: 71), is the broad, non-protuberant, obtusely curved in outline (viewed from above) rostral, only slightly or no longer than broad (nearly twice as long as broad, protuberant, acutely curved in dorsally-viewed outline, in *P. m. sayi*).

The UCM has eight specimens from Mexico: *Chihuahua*: 21060, 14.4 km S Nuevo Casas Grandes; 20458, nr Cd. Chihuahua; 46081, 22.2 mi S Cd. Chihuahua, Hy 45. *Durango*: 21059, 7 mi N La Zarca rd on Hy 45; 20459, 12 mi S Torreón, Hy 45; 21637, 14 mi N Durango. *Sonora*: 47437, 50 mi N Hermosillo, Hy 15; 28162, 44 mi N Guaymas, Hy 15. For comparative purposes, unpublished data are available for USNM 105289, 15 mi N Columbus, New Mexico; MVZ 21030, 7 mi N Santa Rosa (35 mi N Cumpas), Sonora; MVZ 28932, Guasimás, Sonora; Kenneth L. Williams private collection (KLW) 541, 2.8 mi S Camargo, Chihuahua; KLW 741, 34.3 mi s Tlahualilo, Durango; Peter S. Chrapliwy private collection (PSC) 834, 4.2 mi N Cd. Chihuahua, Chihuahua; PSC 969, 6.7 mi NW Bermejillo, Durango; PSC 1005, 40.4 mi E Paila, Coahuila; PSC 1367, 8.3 mi NW Ojo Caliente, Zacatecas; FMNH 986', Villa Ahumada, Chihuahua. Data on these specimens have been supplemented with others in Tanner (1985: 638-9) for 39 snakes from Chihuahua, and in Smith (1943: 459) for nine Chihuahua and two Coahuila specimens.

Our interest in comparisons of these data arose from Klauber's (1947: 43-44) analyses of geographic variation in number of ventrals, subcaudals, midbody scale rows, preoculars, postoculars, body blotches and tail blotches, and in shape of rostral, with extremes occurring to the east and west. He "decided not to split *affinis*," but he had "no doubt such a procedure will eventually be warranted." He was particularly impressed with the geographic consistency of the sums of body blotches and ventrals; the western specimens had a total of more than 280 in males, 285 in females, and eastern ones fewer. Stull herself (1940: 127-9) pointed out the existence of *north-south* clines in number of ventrals, subcaudals and body blotches, and her view is supported by data in Conant (1965: 19-24), Hardy and McDiarmid (1969: 191-2) and Tanner (1985: 638-9).

Although only four (from Sonora) of the 19 specimens included in Table 1, giving states for those characters previously noted to exhibit geographic variation, are from the western half of the subspecies' range, there is no evidence of a level of consistency of variation indicative of the existence of more than one subspecies. Extremes exist peripherally in all directions, and even Klauber admitted that his most consistent criterion (sum of ventral and body-blotch counts) "applies only to territorial extremes, the intervening areas being intermediate." Such a picture of peripheral extremes of variation is consistent with the concept of a single taxon, as in effect was noted long ago by Schmidt (1950: 331).

Although *P. m. affinis* may well occur as far south as Nayarit (from which state it is not yet recorded), inasmuch as Hardy and McDiarmid (1969: 191-2, fig. 79) record it from extreme southern Sinaloa, the record for coastal Michoacán (23 km NW Punta San Telmo) by Alvarez and Diaz (1983: 144-5) requires confirmation; it is almost certainly an error of identification or an introduction, not native to the locality.

Crotalus v. viridis (Rafinesque)

The single specimen taken 2.1 km W Rancho El Gato is reported in detail elsewhere (Lemos et al., 1994).

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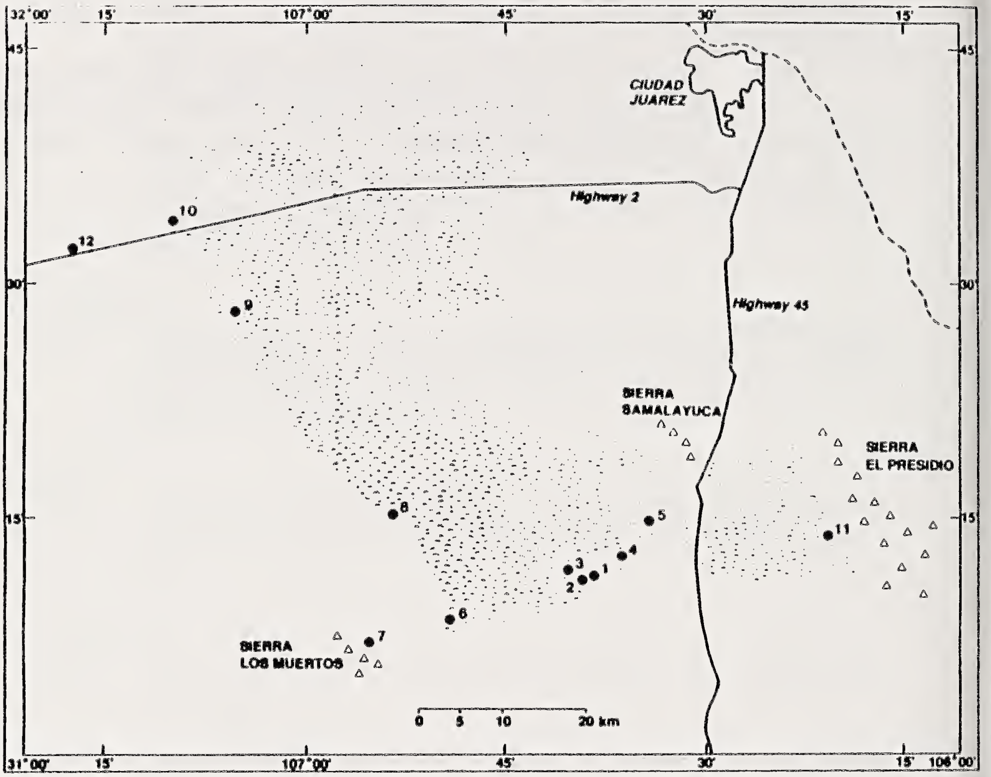

Fig. 1. Collection and orientation localities in the transmontane dune area (shaded) of northern central chihuahua, adapted from the Carta Topográfica series, 1:250000 Detenal, Ciuded Juárez sheet (H13-1), of the Seceretaria de Programación y Presupuesto, Coordinación General del Sistema Nacional de Información, Dirección General de Estudios derritorio Nacional, México. 1, Nuevo Rancho alegre. 2, Rancho La Laguna. 3, Rancho El Jonuco. 4, Ejido El Vergel. 5, Rancho El Gato. 6, Rancho El Snacho. 7, Rancho Los Muertos. 8, Rancho El Congelado. 9, Rho La Barranca. 10, Microondas Duna. 11. Rancho El Sabinoso. 12. San Martin.

Table 1. Geographic Variation in Certain Characters of *Pituophis melanoleucus affinis**

Mus.	No.	State	Sex	1	2	3	4	5	6	7
MVZ	28932	Sono	M	245	58	33	1-1	4-4	44	13
MVZ	21030	Sono	M	-	59	-	2-2	3-5	-	10
UCM	47437	Sono	M	229	58	31	1-1	4-4	39	11
UCM	28162	Sono	M	233	62	33	1-1	3-3	41	12
HMS	36274	Chih	M	217	61	31	1-1	4-4	44	14
UCM	21060	Chih	M	221	66	31	1-1	4-4	46	12
UCM	20458	Chih	M	-	59	31	1-1	3-3	38	10
UCM	46081	Chih	F	229	54	34	1-1	4-4	49	11
FMNH	986	Chih	F	223	53	31	2-2	4-4	59	14
KLW	541	Chih	?	228	49	-	-	-	50 (total)	
PSC	834	Chih	?	224	62	-	-	-	59	
USNM	105289	N.M.	M	226	61	31	1-1	3-4	41	12
PSC	834	Coah	?	238	49	-	-	-	47 (total)	
UCM	21059	Drgo	M	220	60	35	1-1	3-3	47	12
UCM	21637	Drgo	M	223	62	31	1-1	3-4	41	11
UCM	20459	Drgo	F	227	52	31	1-1	3-3	40	10
KLW	741	Drgo	?	229	49	-	-	-	48 (total)	
PSC	969	Drgo	?	224	57	-	-	-	50 (total)	
PSC	1367	Zaca	?	216	68	-	-	-	63 (total)	

*Column nos.: 1, ventrals; 2, subcaudals; 3, median scale rows; 4, preoculars; 5, postoculars; 6, body blotches; 7, tail blotches.

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NOTES ON TAXONOMY OF VENOMOUS CORAL SNAKES (ELAPIDAE) OF SOUTH AMERICA

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In order to better depict evolutionary relationships of coral snake taxa, a series of changes are proposed in several species-subspecies designations. The new arrangement recognizes as species *Micrurus meridensis, M. diana, M. psyches, M. circinalis, M. medemi, M. paraensis* and *M. remotus*, while *M. pyrrhocryptus* has two subspecies: *M. p. pyrrhocryptus* and *M. p. tricolor*, and *M. rondonianus* is reduced to subspecies, *M. hemprichi rondonianus*.

The usual tradition of describing similarly looking but different allopatric populations of a taxonomic unit automatically as subspecies may not always represent accurately the evolutionary history and relationships among them. In systematic biology, and in herpetology in particular, interest is growing to clarify application of the species concept, with some healthy exchanges (Frost and Hillis, 1990; Kluge, 1990; Smith, 1990; Mayr and Ashlock, 1991) occurring to find where the biology of the individual and that of the species meet in evolutionary history. As more data and specimens become available and evolutionary histories of their populations are uncovered, some "subspecific" relationships are better described as "specific" relationships (Collins, 1991; Van Deventer *et al.*, 1992; Frost *et al.*, 1992).

The intent of this paper, however, is not to discuss the concept of species or species-subspecies complexes but to find a better systematic arrangement of New World coral snakes, even though it might not be possible to recover their entire evolutionary history, or lineages. In light of the above, I propose the following changes.

1. *Micrurus psyches.* With the recognition of *Micrurus psyches paraensis* as a full species (Hoge and Romano, 1981), it became necessary to reexamine all the subspecies, their variation and geographical distribution. They apparently represent a natural group but dissimilarities in their features (Table 1) and color patterns might be better understood by recognizing them as full species of a monophyletic group. They all are single-banded, with a black cap, and a long

bifurcated hemipenis, and the males do not have supraanal tubercles (Roze, 1967).

In *M. circinalis* the intensely red single bands have conspicuous black tips. In about 30% of the specimens, the black tips fuse around the white (or yellow) bands forming weak accessory black bands producing an accessory band triad. The anterior temporal is either reduced or fused with the sixth supralabial. Accessory bands and fusion of cephalic scales are considered derived characters.

In *M. medemi* the black bands are 7-10 dorsals long, the black nuchal band is 7-9 dorsals long, and the red bands are melanistic: dark red, purple or almost black. Longer black dorsals in this group of coral snakes is a derived character.

In *M. paraensis* the black nuchal band is 3-4 dorsals long and the black bands are 2-3 dorsals long. The red bands frequently are quite melanistic (as in the holotype of *M. donosoi*) in specimens from southern Pará.

In *M. psyches* the red bands can be completely obscured by black so that only black narrow white bands cover the body, and it has 22-29 original black bands in males and 27-41 in females, more than in any other species of this group.

In *M. remotus* the black nuchal band is about 4 dorsals long and the melanism is not very conspicuous. The variation of the meristic characteristics are given in the Table 2.

The melanistic tendency might not indicate phylogenetic relationships but is the result of a tendency of lowland rain forest "Amazonian melanism" (Roze, 1983), found in several elapid and colubrid species that inhabit Amazon and the foothills of Andes. *M. circinalis*, distributed in Trinidad and northeastern Venezuela (and probably in Guyana) - thus outside Amazon - has intensely red bands and only black tips on red scales are present. The most specialized species is *M. circinalis*, at one end, and *M. remotus* at the other end, but at this stage there are not enough data to offer a meaningful cladogram.

The *M. psyches* group is a monophyletic group distributed in south American lowlands, related to the Andean species of *M. steindachneri*, *M. petersi*, *M. peruvianus* and, perhaps, to *M. mertensi* of the Pacific dry lowland. Its southeastern Brazil relative might be *M. corallinus*.

They can be distinguished as follows:

Key to the *Micrurus psyches* species group

1. Primary black bands shorter than the red bands; black nuchal 5 or fewer dorsals..........2

1a. Primary black bands longer than red bands; black nuchal 7-9 dorsals.......... *Micrurus medemi*
(Villavicencio region, Colombia)

2. Black body bands 20 or fewer.......... *Micrurus paraensis*
(Southern Suriname, and Pará and Maranhao to Rondonia, Brazil)

2a. Black bands 21 or more..........3

3. Less than 200 ventrals in males and 213 or less in females..........4

3a. More than 200 ventrals in males and more than 213 in females.... .... *Micrurus remotus*
(Southern Venezuela, adjacent Brazil and southeastern Colombia)

4. Ventrals 188-196 in males, 203-212 in females; red usually obscured by black.......... *Micrurus psyches*
(Eastern Venezuela, adjacent Brazil and the Guianas)

4a. Ventrals 178-187 in males and 192- 205 in females; red bands distinct, sometimes with weak accessory bands.......... .... *Micrurus circinalis*
(Trinidad and northeastern Venezuela)

2. *M. frontalis*. It is the most complex species or species group, with overlapping distribution of what are currently considered subspecies and clusters of characters that distinguish them. They all are triad type coral snakes, with the first triad complete, variably colored head and bilobed hemipenis. In order to distinguish what might be natural species, I propose to recognize three species: a) *Micrurus frontalis*, with subspecies *M. f. frontalis*, *M. f. altirostris*, *M. f. baliocoryphus*, *M. f. brasiliensis* and *M. f. multicinctus*. All of them have up to 16 black triads and the black bands are a little longer than the white bands. b) *Micrurus pyrrhocryptus*, with two subspecies: *M. p. pyrrhocryptus* and *M. p. tricolor*. Both subspecies have usually fewer than 10 triads and the black bands are much longer than the white bands. c) *Micrurus diana* that in

some way is intermediate between both and is known thus far only from Provincia Chiquiticos, Bolivia. It has 9-11 black triads. *M. p. pyrrhocryptus,* apparently is sympatric in the western Entre Rios, Argentina, with *M. f. baliocoryphus* (Scrocchi, 1990), and *M. p. tricolor* is found sympatric in parts of Mato Grosso, Brazil with *M. f. frontalis.*

3. A full species status is proposed for *Micrurus meridensis* (ex *M. dissoleucus meridensis*), because its hemipenis is different from that of *M. dissoleucus* in being deeply bilobed (see scheme in Roze, 1989) while that of *M. dissoleucus* has a weakly bilobed condition. *M. meridensis* has the number of black triads considerably more numerous than known for the subspecies of *M. dissoleucus*: 18 complete black body triads, vs. 6-11 for all subspecies of *M. dissoleucus.*

4. *M. rondonianus.* An apparently melanistic form of *M. hemprichi,* is herewith reduced to subspecies of the latter, thus *M. hemprichi rondonianus.*

The relationships among the groups of coral snakes, as proposed by Slowinski (1991), and tentatively proposed by Roze and Bernal-Carlo (1987), apparently offer a good overview of their evolutionary relationships. However, until further understanding of coral snake groups and their evolutionary proximity is better understood it is advisable to treat the new genera of Slowinski as subgenera of New World coral snakes. The following species and subspecies of the proposed taxonomic arrangement in this paper belong to *Micrurus* (*sensu* Slowinski): *M. diana, M. pyrrhocryptus, M. frontalis* and *M. hemprichi,* and to *Monodophis* (*sensu* Slowinski): *M. circinalis, M. medemi, M. paraensis, M. psyches* and *M. remotus* (Table 2).

Acknowledgments

I am grateful to Dr. Hobart Smith for his help and advice in revising the manuscript.

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Table 1. Variation of number of ventrals, subcaudals and body bands in the *Micrurus psyches* group. M=males; F=females; N=number of specimens examined. In parenthesis is mean of the sample.

Species	Number		Ventrals		Subcaudals	
	M	F	M	F	M	F
M. circinalis	29	23	178-187 (183.3)	192-205 (196.1)	43-50 (45.9)	30-35 (32.5)
M. medemi	6	3	193-198 (195.0)	211-218 (215.0)	45-49 (46.8)	31-33 (32.5)
*M. paraensis**	6	3	188-200	194-213	42-52	30-38
M. psyches	14	15	188-196 (192.9)	203-212 (208.1)	44-49 (46.4)	30-33 (31.9)
M. remotus	3	4	202-203 (202.3)	214-225 (219.3)	42-49 (46.3)	32-37 (35.3)

Species	Number of black bands			
	Body		Tail	
	M	F	M	F
M. circinalis	22-30 (25.5)	21-31 (27.2)	8-12 (9.8)	6-8 (6.8)
M. medemi	15-22 (18.7)	22-25 (23.3)	7-9 (7.8)	5-6 (5.7)
*M. paraensis**	13-18	10-20	5-14**	
M. psyches	22-29 (25.8)	27-41 (30.7)	7-10 (8.8)	5-7 (6.2)
M. remotus	25-29 (27.3)	29-40 (34.0)	7-8 (8.7)	6-8 (7.0)

* In addition to the 9 specimens examined, data incorporate those by Cunha and Nascimento (1973 and 1978), as well by Nascimento, Avila-Pires and Cunha (1987).

** Combined variation for males and females

Table 2. Summary of changes proposed in coral snake taxonomy.

Presently used	Changed to
	(subgenus *Micrurus**)
Micrurus dissoleusus meridensis Roze, 1969	*Micrurus meridensis*
Micrurus frontalis diana Roze, 1983	*Micrurus diana*
Micrurus frontalis pyrrhocryptus (Cope, 1862)	*Micrurus pyrrhocryptus pyrrhocryptus*
Micrurus frontalis tricolor Hoge, 1956	*Micrurus pyrrhocryptus tricolor*
Micrurus rondonianus Roze and Jorge da Silva, 1990	*Micrurus hemprichi rondonianus*
	(subgenus *Mondophis**)
Micrurus psyches circinalis (Duméril, Bibron & Duméril, 1854)	*Micrurus circinalis*
Micrurus psyches medemi Roze, 1967	*Micrurus medemi*
Micrurus psyches paraensis Cunha and Nascimento, 1973	*Micrurus paraensis*
Micrurus psyches remotus Roze, 1987	*Micrurus remotus*

*)genera, *sensu* Slowinski, 1991, here considered as subgenra.

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A NEW SUBSPECIES OF THE COLUBRID SNAKE *LIOPHIS EPINEPHELUS* FROM SIERRA NEVADA DE SANTA MARTA, COLOMBIA

Amanda Bernal-Carlo

A new subspecies, *Liophis epinephelus kogiorum*, is described from the cloud forest of Sierra Nevada de Santa Marta, Colombia.

Examining collections of the Instituto Nacional de Recursos Naturales Renovables y del Ambiente (INDERENA), Bogotá, Colombia (IND), and the Museum of Zoology, University of Michigan (UMMZ) during my studies of herpetology of the Sierra Nevada de Santa Marta, Colombia, several specimens were discovered that represent an undescribed subspecies of *Liophis epinephelus*. It is here called

Liophis epinephelus kogiorum subsp. nov.

Leimadophis epinephelus: Amaral, 1929: 165 (part).
Leimadophis albiventris: Ruthven, 1922: 66 (part).
Liophis epinephelus epinephelus: Dixon, 1983: 137 (part).

Holotype. IND 3230, adult male, from Ciudad Perdida, Sierra Nevada de Santa Marta, Departamento de Magdalena, Colombia, 1100 m, collected by R. Lleras and M. Velasquez in 1987.

Paratypes. All from Sierra Nevada de Santa Marta, Department of Magdalena, Colombia: IND 3228, a juvenile male and IND 3229, an adult female, from the same locality as the holotype; IND 2289, adult male from Parque Nacional Tayrona, La Frontera-Rio Buritaca, collected by A. Etter; UMMZ 63776 (3 specimens), two juvenile males, one adult female, from Vista Nieve, Serrania San Lorenzo, 1100 to 2700 m, collected by M. A. Carriker Jr. in 1912.

Diagnosis: A subspecies of *Liophis epinephelus* that differs from *L. e. albiventris* in having black lateral spots on the anterior and median part of the body; from *L. e. opisthotaenia* in having a lateral caudal dark stripe that is less than one scale wide, while in the former it is more than one scale wide; and from *L. e. epinephelus* in not having crossbars or irregular bands on the anterior part of the body.

Description of Holotype. Head scutellation that of *Liophis epinephelus*: frontal somewhat triangular; oculars 1+2, upper postocular larger than the lower; 1+3 temporals; supralabials 8, 4th and 5th entering orbit; infralabials 9, first 5 in contact with first pair of chin shields. Dorsals scales in 17-17-15 rows; ventrals 142; caudals 62, all divided, and anal divided. Total length 438 mm; tail length 105 mm.

Coloration: dorsum unicolor, blackish brown; laterally some slightly visible black spots on some scales on the anterior part of the body; from posterior third of body to the tip of the tail a continuous narrow black paravertebral line, less than one scale wide; top of head same as dorsum; rostral and supralabials white, slightly spotted with brown; black narrow stripe on the upper border of all supralabials; head below and venter immaculate.

Description of Paratypes: In most aspects they are similar to the holotype, except occasional 2 posterior temporals and 10(5) infralabials; five males, including holotype, have 140-144 (142.5) ventrals and 60-68 (64) divided subcaudals; the two females have 141-144 (142.5) ventrals and 62-64 (63) divided subcaudals.

Two adults have the black spots on the anterior part of the body more conspicuous and fused posteriorly to form the narrow paravertebral stripe as in the holotype. Juveniles have a light brown dorsum spotted with black anteriorly and a series of conspicuous black lateral spots that fuse posteriorly to form the paravertebral line. the top of the head is uniformly black, with a black nuchal band. The black narrow upper border of supralabials fuses with the nuchal band. Below, head and venter are immaculate. The longest paratype measures 577 mm of total length with 136 mm of tail length, and the ratio tail length/total length ranges from 0.21-0.24.

Notes: the new subspecies is distributed in the cloud forest in the western and northwestern part of the Sierra Nevada de Santa Marta, from 1000 m to about 1700 m, but it well might be found as high as above 2000 m, as indicated by one locality of Carriker: Vista Nieve in the Serrania San Lorenzo. From 1911 to 1913 he made several collections of birds in Santa Marta and this particular locality covers an area between 1100 to 2700 m.

IND 2289 contained a semidigested frog, swallowed head first. The stomach also contained nematode parasites.

The taxonomy of *Liophis epinephelus* was in part interpreted and clarified by Dixon (1980 and 1983) but it needs further studies since the Colombian populations of the species offer more heterogeneity than anticipated.

The subspecies is dedicated to the Kogi Indians of Sierra Nevada de Santa Marta who for centuries shared with the new subspecies the life space of Sierra Nevada de Santa Marta in harmony.

Acknowledgments

For permission to examine specimens, I am indebted to Jorge Hernández, José Vicente Rodríguez and José Vicente Rueda of INDERENA, Instituto de Recursos Natuales Renovables y del Ambiente, Bogotá (IND); and to Arnold Kluge, Greg Schneider and F. Kraus of Museum of Zoology, University of Michigan (UMMZ), while gratitude for help and advice in preparing the manuscript goes to Janis Roze and Hobart M. Smith.

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ANNOUNCING THE MARYLAND HERPETOLOGICAL SURVEY

It's been almost twenty years since the Natural History Society of Maryland, Inc. published the last edition of the Distributional Survey (Amphia/Reptilia): Maryland and the District of Columbia by Herbert S. Harris, Jr. In that time three species have been added to the state's fauna, concepts of the local distribution of many species have changed, and concern has been expressed over the apparent reduction in numbers of various species. The NHSM is initiating a five year survey of Maryland's herpetofauna leading to preparation of a comprehensive publication (or publications) dealing with local herpetology. This survey will have several facets, as described below.

Distributional Data

Species distributions will be depicted with computer generated maps based on the U. S Geological Survey quad system. This will provide a reasonable degree of accuracy, easy update, and reliable documentation. Although the database will be maintained at a central location, county coordinators will be assigned to receive and review data for their area. When this project gets rolling, we anticipate that draft maps will be circulated on a regular basis to identify gaps where special attention should be directed. These maps can be coded to show historic vrs. current records.

As has been traditional with herpetological survey efforts, we welcome data associated with well preserved specimens deposited in a permanent collection. However, consistent with today's emphasis on observation as opposed to collection, we also consider sight records from reliable observers to be acceptable. Unusual occurrences or records for species that may be confused (i.e., "coastal plain milk snakes" and scarlet snakes, or new records for rainbow snakes) should be document photographically, and we encourage maximum use of cameras. The NHSM is establishing an archive for permanent storage of such slides and photographs.

Natural History

The North American literature contains a wealth of information about the natural history of the amphibians and reptiles that occur in Maryland. However, most of that information came from other areas and relatively little is specific to this state. For instance, can anyone precisely define the period during which gray treefrogs or narrowmouth toads call in Maryland? Conant and Collins, because they consider the entire range, give a period that s much too broad. Management of our local amphibian and reptile species requires that we know much more about their life histories than we do. Consequently, we are taking this opportunity to gather every bit of biological information that we can get on every resident species. Participants are encouraged to record and report all biological observations, even those that seem ordinary. A standardized record form will be provided for this purpose. The following list gives examples of the kinds of questions that we hope to answer.

> Have you observed changes in local distribution? Do you see species now that you did not see the past, or vise versa?
>
> When exactly do various species of frogs start and stop calling?
>
> What do our herps eat, and what eats them? What kind of aggressive encounters occur?
>
> When do they mate? When and where do they lay eggs, and how many? Do you note evidence of nest predation, and do you know what did it?
>
> What kind of parasites occur on/in wild caught herps?
>
> Where do our amphibians and reptiles hibernate (have you ever dug out a snake or frog in winter), and when do the enter and leave hibernating areas?

Long-term Population Monitoring

We also propose to coordinate a series of long-term studies at selected localities (one in each county would be ideal) to monitor numbers of reptiles and amphibians at specific locations. These surveys will be modeled after the one now being conducted at the Jug Bay Wetlands Sanctuary in Anne Arundel Count, and should detect and

document any changes that may be occurring in local populations. The role of the NHSM in this effort will be to help establish programs to provide even coverage, to ensure that comparable data is being collected in a standardized fashion, and to collect and evaluate data to formulate a state-wide picture. We can also serve as a clearinghouse for the dissemination of the data obtained to participants and other interested persons.

Another aspect of this survey will be an effort to gather personal observations of changes in abundance and distribution. We constantly hear naturalists lament that spotted salamanders no longer spawn in the pond in their woods or that a favorite copperhead den has been destroyed. Such information has been given little credibility because it is anecdotal, and no effort has been made to verify and quantify it so that it can be considered when management of amphibian or reptile populations is considered. We feel that such information is useful and will make every effort to compile it.

Accessibility of Data

Although our ultimate goal is publication of the data gathered, this will be an interactive association with relatively free access to information. We hope to find funding to computerize early-on. If so, we can generate regular hardcopy updates or open the files through the phone lines. However, security will be placed on sensitive information. The last thing that we want to do is apply additional stress to local populations. On the other hand, so little good information is available that we will strive to get information flowing as soon as we can.

How to Participate

At the present time we plan to begin developing the data base in January 1995. In the interim a "steering committee" has been established to deal with such questions as exactly how data is to be collected and in what form, how it will be packaged, how and where it will be stored, what the data sheets will look like, how access to data will be provided, and what the final products will be. A lot of work remains to be done and we would like to hear form you if you have comments, questions, suggestions, or a desire to assist. A mailing list is being developed and information should start appearing late this summer.

If you are interested in participating in this project please fill out the following form and return it to: **Maryland Herpetological Survey, Natural History Society of Maryland, 2643 North Charles Street, Baltimore, Maryland 21218.**

Name____

Address______________________________________

____

Phone____

Interest: County Coordinator________

(if so, which county ____________________

Suggestions:

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January 18, 1994

Dear Herpetologists;

For many years the Jamaican iguana, *Cyclura collei*, was thought to be extinct until a hunting dog captured one in 1990. The news that the Jamaican iguana still existed brought excitement to the conservation community, however this ray of hope is tempered by the continuing problems that threaten the existence of this species.

Recent surveys suggest that no more than a hundred Jamaican iguanas remain in the Hellshire Hills of Jamaica. This population is threatened by habitat destruction and predation by non-native predators such as mongooses, feral pigs and dogs.

The newly formed Jamaican Iguana Research and Conservation Group, with support from several other organizations, including the Ft. Worth Zoo, have started an ambitious species recovery plan. Research indicates that young Jamaican iguanas are vulnerable to predators, therefore, a headstarting program is underway. About 50% of the young from wild nests are being captured and raised in captivity for four years until they reach a size that will protect them from most predators.

In addition to headstarting the young iguanas, plans are underway to build reintroduction facilities to help the captive raised animals adjust to the wild. To support these efforts habitat conservation and control of non-native predators is necessary. Consideration is also being given to the establishment of another population on an island off the coast of Jamaica.

We need your help! The above projects require financial assistance. Your society can help by encouraging your members, as well as the society itself, to send a contribution to the Jamaican Iguana Research and Conservation Group. In addition, you can publicize the availability of the attractive Save the Jamaican Iguana posters for $12.50. Your society can buy 10 posters for $100 or 25 or more at $8 each (we'll pay postage on the group sales) and resale them at your meetings for a profit or even give them away as door prizes or awards. The proceeds from the sale of the posters will support the Jamaican iguana conservation efforts.

-over-

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Please help ensure that the most endangered lizard in the world does not once again appear on the list of extinct species.

Sincerely,

Rick

Rick Hudson, Chair
AAZPA Lizard Advisory Group
& Assistant Herpetology
Curator

Book Announcement

The Coastal Plains Institute Announces
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Enabling Author to Complete Production of his Natural History Book Entitled

DIAMONDS IN THE ROUGH
Of Rattlesnakes and Men

by D. Bruce Means, Ph. D.

Based on more than 30 years of observations and 20 years of formal study of the Eastern Diamondback Rattlesnake (*Crotalus adamanteus*), this book is the complete natural history of one of North America's most famous and characteristic animals. To be published in 1994, it covers every aspect of the life history and ecology of the fascinating eastern diamondback as discovered from long-term field studies conducted on Tall Timbers Research Station, Little St. Simons Island, and throughout the Coastal Plain range of the species. Originally funded by a National Geographic Society research grant, this large on-going research project was additionally funded by Tall Timbers Research Station, Florida Game and Fresh Water Fish Commission, Coastal Plains Institute, private contributions, and personal funds.

The author is a modern American naturalist who received the B.S., M.S., and Ph.D. degrees from Florida State University, with thesis topics on systematics, competition, and geographical ecology of salamanders of the genus *Desmognathus* in the southeastern U.S. He was awarded graduate and post-doctoral fellowships from Tall Timbers Research Station from 1970-1976, where he served as Director from 1978-1984. He has served as adjunct faculty at Florida State University (1976-present), University of Florida, and Florida A&M and has been Adjunct Curator of Herpetology in the Florida State Museum and a Research Associate of the Smithsonian Institution. In 1984 he founded and has since served as President and Executive Director of the Coastal Plains Institute, a nonprofit environmental education organization working to advance scientific and public appreciation of the Coastal Plain, a large natural region of the southeastern United States. He is also a tropical ecologist having conducted field research and organized and lead natural history classes in Panama (1967), Costa Rica (1977 OTS, 1987), Jamaica (1984), Amazon basin (1988), Galapagos Islands (1989-1991), Venezuela (1991), Australia (1991) and Belize (1992). Dr. Means is contributing editor of the *South American Explorer* magazine where he writes popular articles on natural history and about his travels in the rain forests of South America.

In the spirit of the independent tradition of early North American naturalists, the author wishes to solicit the help of subscribers to enable him to finish writing the text of the complete book. For a contribution of $25.00 you will receive a $20 coupon toward the final purchase price of the book upon publication, PLUS a 20-page softbound prepublication (8 X 11) consisting of eight selected chapters from *DIAMONDS IN THE ROUGH*, illustrated with pen and ink drawings.

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SSAR is pleased to announce its first video production, a recording of the lecture by Professor Walter Auffenberg (University of Florida) presented at the society's 1993 Annual Meeting in Bloomington, Indiana. In this 60-minute video, which is extensively illustrated with color slides, graphs, and other figures, Auffenberg describes and contrasts the behavioral ecology and feeding strategies of three markedly different species of monitors—the Komodo Monitor of eastern Indonesia, Gray's Monitor of the Philippines, and the Bengal Monitor of South Asia. Each species has been the subject of a major book by Auffenberg, and that on the Bengal Monitor was just published by the University Press of Florida. The video includes several film sequences of Komodo Monitors in the wild.

Videotapes may be purchased from DUANE BUSICK VIDEO PRODUCTIONS, 4400 ETTER ROAD, BLOOMINGTON, INDIANA 47408, USA, for US$20 each in the USA, $25 outside the USA (prices include all shipping and handling as well as airmail postage overseas). Payment may be made by personal checks or money orders, *in advance*; sorry, no credit cards or CODs. This is a VHS format tape (NTSC standard, appropriate for USA VCR machines); those who need PAL or SECAM versions may convert from NTSC copies or inquire of Busick Video for additional charges for PAL or SECAM versions (telephone area 812, 336-8329).

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Tropidophis any species
Ungaliophis any species
Loxocemus bicolor
Eryx any species
Lichanura trivirgata
Charina bottae
COLUBRIDAE
Elaphe rosaliae
Elaphe bairdi
Elaphe triaspis
Trimorphodon biscutatus
Lampropeltis ruthveni

*Any endangered species would be by permit only.

I am needing skeletal material of any of the above listed taxa of boids and colubrids - ADULTS ONLY. The specimens are very much needed for ongoing research projects, AND THEY ARE IN NO WAY WANTED FOR COMMERCIAL PURPOSES. All specimens would be properly prepared and cataloged in typical museum format. If you are reluctant to donate specimens, I would be willing to trade live specimens (various colubrids, *Geochelone carbonaria*, etc.) for select frozen specimens, or I would be willing to buy specimens. Moreover, I would cover *all* shipping expenses. I realize it is frustrating when a captive specimen dies, but I can truly put it to good use.

PLEASE contact: Dr. Dennis Parmley, Department of Biology, Georgia College, Milledgeville, GA 31061. (912) 454-0817 - if you get the answering machine, leave your name and number - I *will* return your call. Thank you greatly for your time and help in this.

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The following new books, brochures, and facsimile reprints of classic works have been published recently by the SSAR, and copies are now available for immediate shipment.

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Biologia Centrali-Americana: Reptilia and Batrachia, by Albert Günther. 1885–1902. The standard work on Middle American herpetology with 76 full-page plates measuring 8$^1/_2$ x 11 inches (12 in color). Introductions by Hobart M. Smith, A. E. Gunther, and Kraig Adler. 575 p., photographs, maps. Clothbound $50.00. (*Also*: separate set of the 12 color plates, in protective wrapper $18.00.)

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Handbook to Middle East Amphibians and Reptiles, by Alan E. Leviton, Steven C. Anderson, Kraig Adler, and Sherman A. Minton. 1992. Annotated checklist, illustrated key, and identification manual covering 148 species and subspecies found in region from Turkish border south through the Arabian Peninsula (including Bahrain, Qatar, and United Arab Emirates) and the Arabian (Persian) Gulf. Chapters on venomous snakes and snakebite treatment plus extensive bibliography. 264 p., 32 color plates (220 photographs), maps, text figures. Clothbound $28.00.

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SPACING AND AGGRESSION BETWEEN *CAIMAN LATIROSTRIS* AND *CAIMAN YACARE*

Angel Alberto Yanosky

Broad-nosed (*Caiman latirostris*) and yacare caimans (*C. yacare*) show historical sympatry and are closely related taxa. Both species are sympatric in their known range in central south America (Groombridge, 1987; Grenard, 1991). *Caiman yacare* and *C. latirostris* separated early in the lineage leading to *Caiman crocodylus* subspecies as determined by molecular evidence (Densmore and Owen, 1989).

Successful speciation processes require reproductive isolation and ecological compatibility (Dobzhansky et al., 1983). Aggression as a factor in species formation is poorly known. This type of behavior is a common and adaptive feature within many animal species, principally in spacing out individuals (Nevo et al., 1975).

Broad-nosed caimans and yacares exploit the same habitat in eastern Formosa, northeastern Argentina (Yanosky, 1990), but adult distributions appear to be segregated between dense vegetated areas for *latirostris*, and open water for *yacare*. On the other hand, nesting habits appear to be similar and recently hatched babies are known to be carried to water by females. Females place them along shallow water margins of marshes, and the mother remains in the vicinity. Aggression between species appears to be primarily an ecological determinant, and not important in the speciation process (Wilson, 1975). Once well-established species are held, aggression within species would exceed aggression between species or at least be of similar magnitude. I suspect this is the case for both Argentinian species of caimans. The objective of the present study was to evaluate aggression and spacing at a stage when both reproductive isolation and ecological compatibility of the two species of caimans are complete.

Laboratory experiments were conducted in February 1992 with one year old seven broad-nosed and seven yacare caimans of unknown sex and hatched during El Bagual Breeding Program in late Summer 1991. They were raised in environmental chambers after artificial incubation. Individuals of both species were maintained in separate containers, never in contact with one another and fed a diet of commercial dog-food, cattle liver and heart, following the specifications of Frye (1991).

Animals of equal size were selected to form an homogeneous group but variation between total lengths and body masses made ideal selections impossible. Yacare specimens were 34.94 ± 3.9 cm in length and 131.5 ± 39.2 g in mass. Broad-nosed caimans were 37.85 ± 2.2. cm in length and 174.35 ± 77.2 g in mass.

A test chamber was designed to be as small as possible to induce aggressive behavior in both species, if space was a potential component of aggression. The chamber consisted of a 50 x 30 x 30 glass cage with two "territorial" sides separated by a styrofoam screen which could be elevated to allow contact between each pair of individuals. Animals were placed on either side of the chamber and after some minutes of acclimation, they were allowed to contact each other. Positions of both specimens' anterior body (especially the head) were recorded every 15 seconds during a 60 second period. Position for each animal could be indicated by a marked sheet at the bottom of the glass cage (Fig. 1).

Three different conditions were represented in the cage: 1) deep water (15 cm of water layer) where the animals had to float or swim if on surface; 2) shallow water (4 cm of water layer) where the animals could be "quadrupedal-bottom-walking" (Grenard, 1991); and 3) dry ground (without water), simulating the three conditions caimans encounter in the wild.

Each 15 second positions were recorded for each animal and later assigned a particular value (Fig. 1). The highest score represented the greatest distance between the two individuals. For each test I obtained a particular spacing score (SS) by adding the four values obtained. If any attack was recorded, the latency of attack was obtained in seconds and the value (60 seconds - latency of attack) was added to the particular SS to give the aggression score (AS). In this way, two indices could be obtained: the SS for spacing of particular individuals and the AS as the amount of aggression.

The goal of this study was to evaluate relationships in aggression and spacing between broad-nosed caimans and yacares, but experiments were also designated to examine aggression among individuals of the same species. Thirty trials were carried out interspecifically (61% of all possible) and ten trials (47% of all) intraspecifically.

Experiments were conducted on three different days, one day for each different habitat condition. Temperature was continuously monitored for each trial; water temperature for deep and shallow water conditions, and ground temperature for the dry condition. Bartlett's tests were used to determine homogeneity of variances and because of homoscedasticity, analysis of variance was used to test differences among means (Sokal and Rohlf, 1981). Alpha = 0.05.

As the test animals moved within cage boundaries, locations were easily recorded by one observer. Attacks were observed between individuals in only two experiments. Both attacks were by different individuals of yacares (number 1 and 4) and no aggression was observed between the two caiman species.

Total spacing scores (SS) and ranges obtained for each particular condition were quite similar. The average scores for deep water were 11.6 and shallow water 11.8, both with the same range of values, -8 / 24. Dry ground scores averaged 13.76 with a range of -4 / 24. Temperature during the experiments (table 1) had its greatest variation in the dry ground trials of *latirostris/latirostris* with a coefficient of variation (CV) of 2.11, but all CVs averaged 1.27 ± 0.41 (range 0.73 - 2.11) and there were no significant temperature differences among trials (Fs = 0.42; dF = 8, 141; $p > 0.05$).

No significant differences could be found among three types of trials, deep water, shallow water, and dry ground, based upon average SS (Fs = 0.49; dF = 2, 87; $p > 0.05$). Broad-nosed caimans and yacares spaced out in the same way in the three different conditions (Fs = 1.22 and Fs = 0.82, respectively; dF = 2, 27; $p > 0.05$). Anova was unable to detect attack score (AS) differences among means (Fs = 1.58; dF =1, 58; $p > 0.05$).

Analyses within deep water trials indicated that no significant differences were recorded among spacing for *latirostris/yacare* versus *yacare/yacare* (Fs = 0.26; dF = 1, 38; $p > 0.05$) neither *latirostris/yacare* versus *latirostris/latirostris* (Fs = 0.03; dF = 1, 38; $p > 0.05$). However, shallow water trials for individuals *yacare* versus *yacare* spaced out more than *yacare/latirostris* trials (Fs = 4.86; dF = 1, 38; $0.05 > p > 0.01$). Yacare specimens were more aggressive among each other than to broad-nosed caimans (Fs = 3.48; dF = 1, 38; $0.05 > p > 0.001$). Comparisons between *latirostris/yacare* and *latirostris* among each other did not show significant differences according to their SS means (Fs = 0.26; dF = 1, 38; $p > 0.05$).

The test apparatus was a good way to measure spacing and aggression between these two species of caimans. The space was small enough to elicit aggressive instincts through space stress. The values assignable to each location (Fig. 1) appeared to be accurate, if two animals are in the same location, this paired comparison would obtain value of 0, even when attacks were recorded. It is also possible to locate both specimens in the same location (SS = 0) both the latency to attack would enhance this value.

The results of this study clearly indicate a low level of aggression among the broad-nosed caimans and the yacares. Based upon my experience in handling captive yacares, they are much more docile than *latirostris*. However, absence of attacks among *latirostris* and presence of attacks among yacares would suggest that *Caimen yacare* is the more aggressive of the two species. The two records of attacks during the trials may be incidental encounters.

Scores for each set of trials were similar with broad ranges and large standard deviations. Anovas were unable to detect differences among SS means except for shallow water trials where yacares spaced out more than broad-nosed caimans (Fig. 2). This single significant difference suggest that among yacares, there is a higher level of spacing and aggression. This is in agreement with the hypothesis that within well-established species, aggression within species would exceed that of between species.

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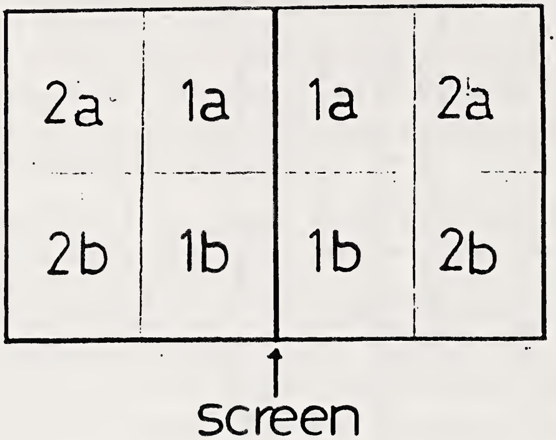
Table 1. Results obtained in spacing scores (SS) for the three different habitat trials with standard deviations (sd) and number of samples (n) for broad-nosed caimans vs. yacares (1), yacares vs yacares (2) and broad-nosed caimans vs. broad-nosed (3) with average temperatures (T°C) during the trials.

SS	11.60	9.30	10.90	11.86	14.00	10.10	13.76	13.40	15.20
sd	10.90	10.24	9.91	9.66	9.12	8.30	6.60	7.07	4.13
n	30	10	10	30	10	10	30	10	10
T°C	29.99	30.11	30.14	30.20	30.11	30.03	30.08	29.92	29.78
s	0.37	0.35	0.33	0.34	0.32	0.36	0.54	0.22	0.63
	1	2	3	1	2	3	1	2	3
	deep			shallow			dry		



	1a	1b	2a	2b	1a'	1b'	2a'	2b'
1a	+1	+2	+3	+4	0	-1	-1	-2
1b	+2	+1	+4	+3	-1	0	-2	-1
2a	+3	+4	+5	+6	-1	-2	0	-1
2b	+4	+3	+6	+5	-2	-1	-1	0
1a'	0	-1	-1	-2	+1	+2	+3	+4
1b'	-1	0	-2	-1	+2	+1	+4	+3
2a'	-1	-2	0	-1	+3	+4	+1	+6
2b'	-2	-1	-1	0	+4	+3	+6	+1

Figure 1. Experimental design of spacing in both species of caimans. Above, the bottom of the cage with the four possible locations for each "territorial" side separated by styrofoam screen. Below, the values assignable to paired comparisons of locations. If any location is '-marked it means the animal has moved to the other side of the cage in which it was located.

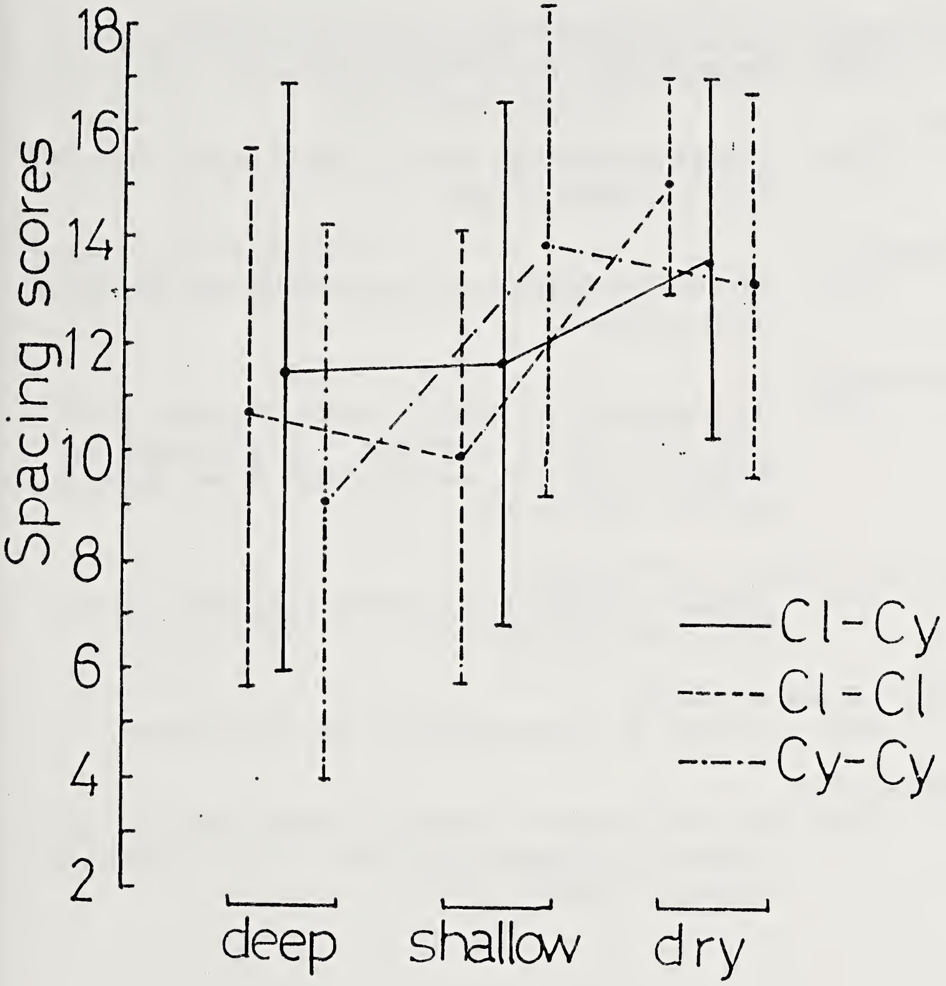


Figure 2. Spacing scores (SS) for interspecific and intraspecific comparisons for broad-nosed and yacare caimans for the three different habitat trials.

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A TENTATIVE ARRANGEMENT OF SUBGENERA OF THE GENUS *LIOLAEMUS* WIEGMANN (REPTILIA: SQUAMATA: TROPIDURIDAE)

Raymond F. Laurent

A monotypic new subgenus, *Austrolaemus*, is erected for *Proctotretus magellanicus* Hombron and Jacquinot, and its relationships with other subgenera and species of *Liolaemus* Wiegmann sensu lato are discussed. The subgeneric allocation of *L. cuyanus* Cei and Scolaro is analyzed, without definitive conclusion.

The considerable number of species in the genus *Liolaemus*, now placed in the recently (Frost and Etheridge, 1989) revived family Tropiduridae Bell (of which the genus is the type of the subfamily Liolaeminae) makes desirable its subdivision into subgeneric entities. The obstacle of possible paraphyly is not a serious consideration in such subdivision, because subgeneric taxa are optional in usage.

The distinction of two major groups, first called Chilean and Argentinian, was proposed long ago (Laurent, 1983b), and has since then been confirmed (Laurent, 1985) and approved (Etheridge and DeQueiroz, 1988). Subgeneric names were already available for them: *Liolaemus* sensu stricto for the Chilean and *Eulaemus* Girard (1858) for the Argentinian group.

Other groups less speciose are distinguishable as well, and some already have been named. Certain recently proposed genera can justifiably be reduced to subgenera. Such is the case of *Vilcunia* Donoso-Barros and Cei (1971) and *Ceiolaemus* Laurent (1984), as well as *Rhytidodeira* Girard (1858) for *L. kingi*, *L. archeforus* and *L. ruizleali* (if the latter is not a synonym of *L. rothi* as held by Cei and Scolaro (1987) and Cei (1990); in my opinion, *L. ruizleali* is a senior synonym of *L. kingi somuncurae* Cei and Scolaro, but its status hinges on the identity of the type of *L. ruizleali* - a problem as yet not solved).

The sister group of *Vilcunia* is a single species, the southernmost of *Liolaemus*, *L. magellanicus* (Hombron and Jacquinot), the only one living in Tierra del Fuego. I here propose a monotypic subgenus for it,

Austrolaemus, subgenus novum

Diagnosis. Scales around middle of body 36-42; dorsal scales large, keeled, pointed, 8 or 9 in head length (Hellmich's index); infradigital lamellae under 4th finger 13-15, rarely 16; infradigital lamellae under 4th toe 15-19; 12-15 scales across snout between supralabials behind nostrils, 11-16 in front of eyes; tail short; distance between armpit (axilla) and ingle (groin) more than 35% SVL in males and 38% in females; 4-5 preanal pores in males; ear opening small, its width less than 30% of width of mental scale.

Type. Proctotretus magellanicus Hombron and Jacquinot, 1847.

Content. Monotypic.

Discussion. Preanal pores distinguish *Austrolaemus* from *Vilcunia* and some species of the nominotypical subgenus. The low number and large size of the dorsal scales occur also in some species of *Eulaemus*, but not with the concomitant keels and elongate shape. The dorsal scales are more like those in some species of the subgenus *Liolaemus* (e.g. *L. gracilis, L. alticolor*), but the long tail of the latter contrasts with the short tail, generally shorter than body, of *L. magellanicus*.

The number of subdigital lamellae averages lower than in other subgenera, although some variational overlap has been observed in many species e.g. *L. wiegmanni, L. ortizi, L. fittkaui.* Finally, the narrow ear opening, presumably an adaptation to cold since it occurs in southern forms like *Vilcunia* and *Rhytidodeira*, distinguishes *Austrolaemus* from *Eulaemus* and *Liolaemus* sensu stricto.

The status of *L. cuyanus* Cei and Scolaro merits special consideration. Some years ago I had considered establishing a monotypic subgenus for the species because, although described as a subspecies of *L. fitzingeri*, it differs from that species and others of *Eulaemus* by characters correlated with its arenicolous adaptations (e.g., long claws, used in burrowing; short internasal space, with nostrils on top of snout, permitting burial with freedom to breathe).

Since such adaptive characters also exist in *Ortholaemus* (except for *L. wiegmanni*), it might seem obvious at first sight that *L. cuyanus* belongs to that subgenus - all the more so since it, like *Ortholaemus*, has six scales in contact with mental instead of the customary four. *Ortholaemus*, however, is also characterized by the multiplication of the lorilabials between subocular and supralabials, whereas *L. cuyanus* has, like other species, a single series of lorilabials, sometimes interrupted so that the subocular contacts the labials. In this respect, *L. wiegmanni* is a perfect *Ortholaemus*, although not arenicolous and therefore lacking corresponding adaptations (i.e., with a wider internarial space and claws not elongate). Hence two evolutionary tracks appear to have existed from *Eulaemus* to *Ortholaemus*: one in which non-adaptive (presumably) character-states (like the multiplication of lorilabials) appeared first (*L. Wiegmanni*), and another in which arenicolously adaptive character-states (long claws and nostrils on top of snout) appeared first (*L. cuyanus*).

Two different paths for a single result makes little sense. Therefore, I am inclined to think that *L. cuyanus* does not belong to *Ortholaemus*. Other reasons exist for that opinion. First, adaptive characters often appear repeatedly in parallel and convergent ways, and in themselves do not necessarily reflect relationships. Secondly, *L. cuyanus* is a large lizard, like *L. fitzingeri*, whereas *L. wiegmanni* is a small species, like *L. darwinii* on one hand and the species of the *multimaculatus* group on the other. Serology shows a close relationship between *L. cuyanus* and *L. melanops* (Cei and Scolaro, 1980), and electrophoresis similarly indicates close relationship between *L. wiegmanni* and *L. darwinii* (Noriega et al., 1986), confirmed by the lower morphometric distance between *L. darwinii, L. wiegmanni* and the closely related *L. ornatus* (Laurent, 1984). However, Richard Etheridge (in litt. and pers. comm.) does not share my opinion. Therefore I now refrain from proposing a separate subgenus for *L. cuyanus*, awaiting more convincing evidence on which to take a stand.

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HISTORY OF THE AUTHORSHIP OF THE NAME OF THE FENCE LIZARD, *SCELOPORUS UNDULATUS* (BOSC AND DAUDIN IN SONNINI AND LATREILLE)

Edwin L. Bell

The name and correct authorship of the Eastern fence lizard is *Sceloporus undulatus* (Bosc and Daudin in Sonnini and Latreille). Cope (1900) gave sole authorship to Latreille, and most authors followed him. Harper (1940) was the first to correct authorship from Latreille to Bosc and Daudin. A number of reasons for incorrect authorship are given.

The subspecies of the Fence Lizard, *Sceloporus undulatus,* range from the Atlantic coast westward to Utah and Arizona and southward into Florida, Texas, and northern Mexico, and are one of the commonest lizards in the United States (Smith et al., 1992). Unfortunately the authorship has been incorrectly cited in many herpetofaunal books and papers for at least ninety years. This paper affirms the authorship, first corrected by Harper (1940), and reviews its history. Reasons for the error are suggested.

Confusion of authorship of this species is due to lack of any Code in 1801 and 1802; the rarity and difficulty in dating publications of Daudin, and of Sonnini and Latreille, who used the Republican calendar following the French Revolution; and the Cope (1900: 368) dating of Daudin (An X [1802], 3: 384) as "1805". Harper (1940) meticulously studied and translated portions of Sonnini and Latreille (An X,[1801]), Daudin (An X [1802a] vol. 3), and Daudin (An XI [1802b]). Harper (1940) stated that Latreille was not the sole author of this species, but that L. A. G. Bosc and F. M. Daudin were the authors, the first description of which appeared in Sonnini and Latreille (An X, [1801], 2: 40), as *Stellio undulatus.* Banta (1961) drew attention to Harper's conclusion, and also dated Daudin's Vol. 3 as "1805". However few authors paid attention to or agreed with these corrections, and Latreille continued to be cited as sole author in most papers for more than ninety years after Cope (1900).

The beginning date of the French Republic, Sept. 22, 1792, is "An I". "An X" means "ten years following the beginning of the French

Republic", and corresponds to Sept. 23, 1801 to Sept. 22, 1802. All four volumes of Sonnini and Latreille are dated "An X" [1801]. Daudin's volumes 1-4 are dated "An X" [1801-1802], and volumes 5-8 "An XI" [1803]. Determination of more precise datings is critical here. Since Daudin's Volumes 1 and 2 refer to "methode de Latreille" and have page references to Sonnini and Latreille (1801), Harper (1940:701), with other cross referencing, concluded that the Sonnini and Latreille work antedated Daudin's first two volumes. He also suggested that Sonnini and Latreille (An X [1801]) was published in September or October, 1801, and that volumes 1 and 2 of Daudin (An X [1801]) were published in December, 1801 and volumes 3 and 4 of Daudin (An X [1802]) in August, 1802. He stated that these should be accepted as bona fide dates. These Gregorian calendar dates are presumably when Daudin presented these volumes to the French Academy of Sciences (Harper, 1940: 715). These publication dates are followed here.

Daudin (An X [1802], 3:384) placed Bosc's *Lacerta undulata* in the genus *Agama*, and indicated in a footnote "*Lacerta undulata*. Bosc, Description manuscrite communiquee - *Le stellion ondule*, Daudin, Hist. Naturelle des reptiles, par Latreille, in -18, tom II, pag. 40." The status of this footnote, where Daudin claims authorship of the species, is critical. Bosc's manuscript to this date has not been located and may be presumed lost. Inquiries to several French museums and academies have not located it. Brygoo (1989: 100) correctly considered *Lacerta undulata* a *nomen nudum*, since it is a name without a description. This status does not invalidate partial authorship by Bosc, since his species name (*undulata*) and description were used by Daudin. The citation by Daudin of himself as author of this species in Latreille's portion of Sonnini and Latreille is the most convincing assertion that Daudin shared the original description of this lizard. The description begins with "Le stellion ondule, *stellio undulatus*" (Sonnini and Latreille, An X [1801], II:40). In addition the first sentence is translated "M. Daudin owes the knowledge and description of this new species to the naturalist Bosc." The final paragraph of the description ends with "It lives in the great forests of Carolina, and hides itself under dry bark; one cannot easily be caught because it is very agile." Bosc (1803: 225) states "It [*Le stellion ondule*] is found in Carolina, where I have observed, described, and drawn it . . . . Its description is given in l'Histoire des Reptiles by Latreille."

Daudin (An X [1802] 3:384) acknowledged use of specimens supplied by Palisot Beauvois, and to the aid by Bosc a "naturaliste egalemant recommandable par ses nombreuses observations". To what extent Daudin modified the manuscript description of Bosc in preparing the description published in Sonnini and Latreille, with some specimens from Beauvois in hand, is not known. Louis Augustin Guillaume Bosc fled the French Revolution, and sailed for Charleston, S. C. on 8 July, 1796, arriving there on 14 Oct., 1796 (Beale, 1978). Although he made Charleston his headquarters, he made at least two journeys, one to Wilmington, Del., and one to Tennessee, where he collected many specimens (Leroy, 1970). He left America on 5 August, 1798, landed in Spain, and proceeded overland to France. The common Bosc pear was named for him (Hedrick, 1921).

Since the author is preparing the account of this lizard for the Catalogue of American Amphibians and Reptiles, and since the problem of species authorship needed firm resolution, photocopies of pertinent documents relating to the authorship were sent to Mr. Philip Tubbs, of the International Commission on Zoological Nomenclature. He was asked if he could give an informal opinion on the authorship, or whether the question had to be settled by a formal appeal to the Commission.

Mr. Tubbs graciously replied (1 April, 1992): "I have looked at all the photocopies you kindly sent, and also Sonnini and Latreille (S. & L.) [1801]. It is evident that Bosc saw and (in manuscript to Daudin) named the lizard '*Lacerta undulata*'. The name was first published in S. and L., as *Stellio undulatus,* by October 1801. In the preamble to S. and L., Latreille acknowledges that the description of many 'lezards' was by Daudin, who in turn acknowledged Bosc in the case of *undulatus.* There is evidently no neat way of summarizing the history, but I consider the species should be described [cited] as: *Stellio undulatus* (Bosc and Daudin in Sonnini and Latreille) [1801]. This pragmatic solution is in accord with the Code, and is, as it happens, the same conclusion as reached by Harper (1941, p. 712). The authorship is not part of the name (Article 51a of the Code), and I don't think further consideration is necessary.

The name *undulata,* as published by Daudin shortly after in *Agama,* is not a homonym of the above but just another use of the same name, in a different generic combination. It has no nomenclatural significance. The valid name is *Sceloporus undulatus* (Bosc and Daudin in Sonnini and Latreille [1801])."

The translation of the Sonnini and Latreille preamble (1801: 215), referred to by Mr. Tubbs, which introduces the lizard section, follows. "M. Daudin, known favorably for his Ornithology, and for several publications on mollusks, has had the goodness to communicate to me excerpts of the descriptions that he has made of several reptiles of the family of lizards, as well as another abridgment of work which has just been done and of the one he is preparing on the toads, frogs, tree frogs, etc. Several figures have been copied from his sketches. It will please me, in citing him to pay him both the tribute of my esteem and that of his friendship." Latreille evidently wrote this paragraph.

Harper (1940: 701) translates another important passage from Daudin's (An XI [1802]) "Rainettes" paper: "All the batrachians of which I have already given an abridged description in the Histoire Naturelle des Reptiles, by Latreille, will be indicated in this new work by an asterisk following the specific Latin name. I ought to observe, however, that the following descriptions include numerous additions and some corrections.

"Some of the drawings which are used in the present work, and which were made by Barraband, have been utilized by M. Deseve, who has merely reduced them and published them by error *under his name* [italics by Daudin], in the little edition of the Histoire Naturelle des Reptiles, on which I have worked with my friend Latreille, for the Deterville publishing firm." " Paris 20 Feb., 1802." A major point here is that Daudin clearly states he "worked" on the reptile portion of Sonnini and Latreille, Histoire naturelle des Reptiles, and is additional evidence that Daudin wrote some sections.

Daudin used asterisks in the "Rainettes" paper to clearly claim his authorship to species. Clarification of which person described a species, if it was claimed by a different author, was evidently made in those times by these types of notations. No International Commission for Zoological Nomenclature existed then as a clearing house for such disputes. The Fifth International Zoological Congress established such a commission in 1901, and a genesis of the Code was published in 1905 as "Regles internationales de la Nomenclature Zoologique". The first edition of the International Code of Zoological Nomenclature was published in 1961.

Many authors previous to 1907 named Bosc, Daudin, or both as authors of the species and ignored Latreille. In most of these the species authorships cited are quite clear. In a few of these early works it is difficult to determine whether the name following the species name is intended as the author of the species, or the author of the paper. Such citations where the name following the species refers clearly to a

PAPER'S authorship, and not to the species authorship are indicated by an asterisk (*) in the following partial synonymy and abbreviated chresonymy (latter term by Smith and Smith, 1973). Chresonymy refers to a summary of "usages" of any given set of scientific names. Synonymy refers to either different names for the same thing (usually synonyms), or in reference to all "occurrences" of a name or set of names. Citations without asterisks refer to authorships of the species.

Merrem, B. 1820: 57. "*Stellio undulatus*. Latr.", "*Agama undulata*. Daud. " [Merrem placed these names as junior synonyms in another generic taxon as *Uromastyx undulata* (Merrem). These are three of the five genera in which the species was placed previous to Wiegmann, 1834.]

Kuhl, H. 1820: 113. "A. *undulata* Daud."

Harlan, R. 1827. Proc. Acad. Nat. Sci. Phila. 6(pt. 1):1-38. On p. 13 is listed "*Agama undulata*. Synonyma. *Lacerta undulata*, Bosc. *Le stellion ondule*, Daudin, Hist. Nat. des Rept. par Latreille, Tom. II, p. 40. *L'agame ondule*, or *Agama undulata*, Daudin, Hist. Nat. des Rept. suite de Buffon." Quoted portion is repeated in Harlan, R. 1835, p. 140.

Cuvier, G. 1829, 2:38. "(1) *Ag. undulata*, Daud.,": [A footnote places *Ag. undulata* in *Tropidolepis*, a new genus, a one year junior synonym to *Sceloporus* Wiegmann, 1828.]

Wiegmann, A. F. A. 1828. Beitrage zur Amphibienkunde. Isis von Oken, 21(3/4): 364-383. (The original definition of the genus *Sceloporus* is on p. 369.)

____. 1834. "1. *Sc. undulatus*. m. (*Agama undulata*. Daud., *Uromastix und.*, *Merr., *Tropidolepis und.* *Cuv. *Gray. *Lacerta fasciata* et *hyacinthina* Green.) Americae septentrionalis incola." (This is the first placement of *undulatus* in the genus *Sceloporus* Wiegmann.)

Dumeril, A. M. C. and G. Bibron. 1837, 4: 298. "Le tropidolepide ondule. **Tropidolepis undulatus*. Cuvier." (Nine entries are in a synonymy following the above name.)

Holbrook, J. E. 1842. II: 73. "*Tropidolepis undulatus*.--Bosc"

Gray, J. E. 1845: 208. *"*Tropidolepis undulatus*, Cuv. R. A. ii. 38." "*Lacerta undulata*, Bosc MSS. Latr. R. ii.40 Daud. R. iii. 884" (sic). ["884" should be "384"].

Hallowell, E. 1853: 144. In Sitgreaves . . . "*Sceloporus undulatus*, Bosc." [from Red Fork of the Arkansas, Creek boundary; New Mexico, west of the Rio Grande].

Wied [Neuwied], Maximilian Prinz. 1865:61. "1. *T.* [*Tropidolepis*] *undulatus* Bosc. *Cuv." p. 61.

Bocourt, M. F. 1870. [date from Smith, H. M. and R. B Smith, 1973b, p. x]. Fig. 11 on Planche 18 is titled: "*Sceloporus undulatus* (Bosc)".

Garman, S. 1884. "*Stellio undulatus* (Bosc) Latr., Rept., II,40."

Boulenger, G. A. 1885: 227; 1897: 503. "*Agama undulata* (Bosc), Daudin."

Gunther, A. C. L. G. 1890: 67. "7. **Sceloporus undulatus**. [Gunther's bold type]. *Agama undulata,* Daud. Rept. iii. p. 384." [in synonymy].

Nelson, J. 1890: 778. "*S. undulatus* Daudin (*tropidolepis*)".

Hay, O. P. 1892: 540 "*Sceloporus undulatus,* (Bosc)."

Stone, W. 1906: 168 "*Sceloporus undulatus* (Daudin)".

Fitzinger (1843) and Gravenhorst (1837) list synonymies with some of the above authors, but make no particular effort to indicate authorships of *Sceloporus undulatus*. Their works are bibliographic (*sensu stricto*) rather than attempts to list species' authorships.

Subsequent to 1900, Gambino (1958) and Gambino and Heyneman (1960) credited Daudin with sole authorship. Stevenson (1976) credited Bosc with sole authorship, and referred to Banta (1961) in a footnote. Cole (1983: 12) stated the authors should be "(Bosc and Daudin, in Sonnini and Latreille, 1801)". Collins (1990) cited "(Bosc and Daudin, 1801)" as authors in the most recent list of common and scientific names. The above titles indicate that a number of prominent authors recognized Bosc, Daudin, or both as authors of this species.

Cope (1900: 368), after the title "*Sceloporus undulatus* Latreille", cited in the synonymy of *Sceloporus undulatus* combinations with three other genera: "*Lacerta undulata* Bosc, manuscript. *Stellio undulatus* Latreille, Hist. Rept., II, 1802, p. 40. *Agama undulata* Daudin, Hist., Rept., III, 1805, p. 384." Cope's dating of Latreille's publication has the 1802 date, and this is understandable, since "An X" is equivalent to Sept.

23, 1801 to Sept. 22, 1802. Daudin's original edition, with colored plates, of volumes 1-4 of "Histoire naturelle des Reptiles" has the date "An X" [1801-1802]. Harper (1940: 715) stated that a second set of volumes 1 and 2, with uncolored plates are reprints and bear the date "An XIII" [1805]. Both have been seen by me at the Academy of Natural Sciences of Philadelphia. This three year difference between the original (1801-1802) and a reprint (1805) volume may have been the reason that Cope (1900: 368) cited Daudin's vol. 3 as published in 1805 instead of 1802. The presumption that Cope cited the reprint date for Daudin's work would clarify why the incorrect authorship has been cited for more than ninety years. If this 1805 date were valid, and if Daudin's description of this lizard in Sonnini and Latreille (An X [1801]) were disregarded, this would have given Latreille a clear priority over Daudin as author. Cope's authoritative volume was followed by almost all authors subsequent to 1900. Current dating (Harper 1940: 693, 701) of these works indicates Sonnini and Latreille (Vol. II) was published in 1801 and Daudin (Vol. III) in 1802.

Harper (1940: 712) concluded that the species should be cited as "*Sceloporus undulatus* Bosc and Daudin, in Sonnini and Latreille". Harper's placement of a comma after "Daudin", and his omission of parentheses around the authors, do not follow present rules of the Code: Art. 51, Recommendation 51B; Art. 51 (c). Harper's recommended change in authorship went largely unnoticed until Banta (1961: 136) drew attention to the matter, and stated the correct authorship should be "*Sceloporus undulatus* Bosc in Latreille". Banta's short paper was also ignored by almost all authors of area herpetofaunal studies. In complex authorship citations, the current Code places the authors of the taxon being described preceding the "in", and the authors of the actual work in which the description appeared following the "in", *with no comma* (Code, Recommendation 51B). However, Art. 87, (b) of the Code states that recommendations do not form part of the legislative text of the Code, hence punctuation and publication (as opposed to description) of authorship citation are not mandatory, but are recommended. The date of the publication is a helpful concluding addition. In Sonnini and Latreille (An X [1801]), Sonnini was the author of the "discours preliminaire" [vol. 1, pp. iii-xxii] and the salamander portion [vol. 2, pp. 188-264], and Latreille is credited with most of the rest of the account, including most of the reptiles (Harper, 1940: 700).

Yarrow (1875: 569-572) gave descriptions for three species correctly ascribed to Cope. Were it not for the description there of *Sceloporus jarrovii* Cope, and *Sceloporus tristichus* Cope, the names might be *nomina nuda*. Cope (1875) first listed one of these as "sp. nov." in his checklist as "*Sceloporus jarrovii*, Cope, MS., Zool. Wheeler's Expl. west of the 100th merid., 1875. Sonoran region (Southern Arizona)." Complete recommended citations of these three species follow, with dates of publication."*Sceloporus jarrovii*, Cope, *sp. nov*." should be cited *as Sceloporus jarrovii* Cope in Yarrow 1875. "*Sceloporus tristichus*, Cope, *sp. nov*." should be cited as *Sceloporus undulatus tristichus* Cope in Yarrow 1875. "*Sceloporus smaragdinus*, Cope, *sp. nov*." is in the synonymy of *Sceloporus occidentalis longipes* Baird, and should be cited as *Sceloporus smaragdinus* Cope in Yarrow 1875. The type localities of the latter species were: "Beaver, Utah. . . Nevada . . . Dome Canyon, Utah"). It is in the synonymy of *Sceloporus occidentalis longipes* Baird (Bell, 1954), and all three localities are within its range. The author has seen the four syntypes of *S. smaragdinus* (USNM 8612).

The law of priority was not fully recognized nor followed at the beginning of the nineteenth century (Harper, 1940: 704). In summary, the lizard now known as *Sceloporus undulatus* was first described in 1801 in Sonnini and Latreille's second volume. Daudin evidently contributed much to that description. He claimed authorship and gave credit to Bosc's manuscript (Daudin, 1802a). A number of important herpetological authors cited Bosc, Daudin, or both as authors of the species previous to Cope (1900). The recommended citation and punctuation is *Sceloporus undulatus* (Bosc and Daudin in Sonnini and Latreille).

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ANNOUNCING THE MARYLAND HERPETOLOGICAL SURVEY

It's been almost twenty years since the Natural History Society of Maryland, Inc. published the last edition of the Distributional Survey (Amphia/Reptilia): Maryland and the District of Columbia by Herbert S. Harris, Jr. In that time three species have been added to the state's fauna, concepts of the local distribution of many species have changed, and concern has been expressed over the apparent reduction in numbers of various species. The NHSM is initiating a five year survey of Maryland's herpetofauna leading to preparation of a comprehensive publication (or publications) dealing with local herpetology. This survey will have several facets, as described below.

Distributional Data

Species distributions will be depicted with computer generated maps based on the U. S Geological Survey quad system. This will provide a reasonable degree of accuracy, easy update, and reliable documentation. Although the database will be maintained at a central location, county coordinators will be assigned to receive and review data for their area. When this project gets rolling, we anticipate that draft maps will be circulated on a regular basis to identify gaps where special attention should be directed. These maps can be coded to show historic vrs. current records.

As has been traditional with herpetological survey efforts, we welcome data associated with well preserved specimens deposited in a permanent collection. However, consistent with today's emphasis on observation as opposed to collection, we also consider sight records from reliable observers to be acceptable. Unusual occurrences or records for species that may be confused (i.e., "coastal plain milk snakes" and scarlet snakes, or new records for rainbow snakes) should be document photographically, and we encourage maximum use of cameras. The NHSM is establishing an archive for permanent storage of such slides and photographs.

Natural History

The North American literature contains a wealth of information about the natural history of the amphibians and reptiles that occur in Maryland. However, most of that information came from other areas and relatively little is specific to this state. For instance, can anyone precisely define the period during which gray treefrogs or narrowmouth toads call in Maryland? Conant and Collins, because they consider the entire range, give a period that s much too broad. Management of our local amphibian and reptile species requires that we know much more about their life histories than we do. Consequently, we are taking this opportunity to gather every bit of biological information that we can get on every resident species. Participants are encouraged to record and report all biological observations, even those that seem ordinary. A standardized record form will be provided for this purpose. The following list gives examples of the kinds of questions that we hope to answer.

> Have you observed changes in local distribution? Do you see species now that you did not see the past, or vise versa?
>
> When exactly do various species of frogs start and stop calling?
>
> What do our herps eat, and what eats them? What kind of aggressive encounters occur?
>
> When do they mate? When and where do they lay eggs, and how many? Do you note evidence of nest predation, and do you know what did it?
>
> What kind of parasites occur on/in wild caught herps?
>
> Where do our amphibians and reptiles hibernate (have you ever dug out a snake or frog in winter), and when do the enter and leave hibernating areas?

Long-term Population Monitoring

We also propose to coordinate a series of long-term studies at selected localities (one in each county would be ideal) to monitor numbers of reptiles and amphibians at specific locations. These surveys will be modeled after the one now being conducted at the Jug Bay Wetlands Sanctuary in Anne Arundel Count, and should detect and

document any changes that may be occurring in local populations. The role of the NHSM in this effort will be to help establish programs to provide even coverage, to ensure that comparable data is being collected in a standardized fashion, and to collect and evaluate data to formulate a state-wide picture. We can also serve as a clearinghouse for the dissemination of the data obtained to participants and other interested persons.

Another aspect of this survey will be an effort to gather personal observations of changes in abundance and distribution. We constantly hear naturalists lament that spotted salamanders no longer spawn in the pond in their woods or that a favorite copperhead den has been destroyed. Such information has been given little credibility because it is anecdotal, and no effort has been made to verify and quantify it so that it can be considered when management of amphibian or reptile populations is considered. We feel that such information is useful and will make every effort to compile it.

Accessibility of Data

Although our ultimate goal is publication of the data gathered, this will be an interactive association with relatively free access to information. We hope to find funding to computerize early-on. If so, we can generate regular hardcopy updates or open the files through the phone lines. However, security will be placed on sensitive information. The last thing that we want to do is apply additional stress to local populations. On the other hand, so little good information is available that we will strive to get information flowing as soon as we can.

How to Participate

At the present time we plan to begin developing the data base in January 1995. In the interim a "steering committee" has been established to deal with such questions as exactly how data is to be collected and in what form, how it will be packaged, how and where it will be stored, what the data sheets will look like, how access to data will be provided, and what the final products will be. A lot of work remains to be done and we would like to hear form you if you have comments, questions, suggestions, or a desire to assist. A mailing list is being developed and information should start appearing late this summer.

If you are interested in participating in this project please fill out the following form and return it to: **Maryland Herpetological Survey, Natural History Society of Maryland, 2643 North Charles Street, Baltimore, Maryland 21218.**

Name____

Address______________________________________

____

Phone____

Interest: County Coordinator________

(if so, which county ______________________

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INFORMATION REQUEST

All Public and private collectors holding live reptiles and/or amphibians in captivity is asked to contribute to this annual report

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by Frank & Kate Slavens

Breeding, longevity, & inventory information current as of January 1st of each year is being solicited for inclusion in our next annual edition. The current edition contains 534 pages of information on 49,618 specimens held in 295 collections. Longevity and inventory information should be current as of January 1st. and breeding information should be complete for the previous year. Information does not need to be typed, nor does it have to be in any kind of order, just try to make it legible and as complete as possible.

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(2) A list of all species bred during the previous year. Bare minimum would be to mark the species bred and indicate if they laid eggs or gave live birth. If possible include more detailed notes of a paragraph or more. Be as detailed as possible.

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(4) Please be sure to list your name, address and telephone number, fax as you want them listed. Please be legible. Anonymous submissions will be considered, try to at least list your name and state..

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This index is an ongoing project designed to compile as much herpetological literature as possible into a single volume. All societies/organizations are encouraged to participate in the index by exchanging publications with the Utah Association of Herpetologists (UtAH). On the reverse side of this letter is a list of all societies currently exchanging publications with UtAH and those which the compiler subscribes to. All of these publications are included in the index, along with hundreds of papers from other sources.

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Free Copy of "Turtles of Venezuela" for Students Attending the August Meeting

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Dr. Peter Pritchard will be in attendance at the meeting and has kindly agreed to autograph copies on request.

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with an introduction by Glenn M. Shea (University of Sydney)

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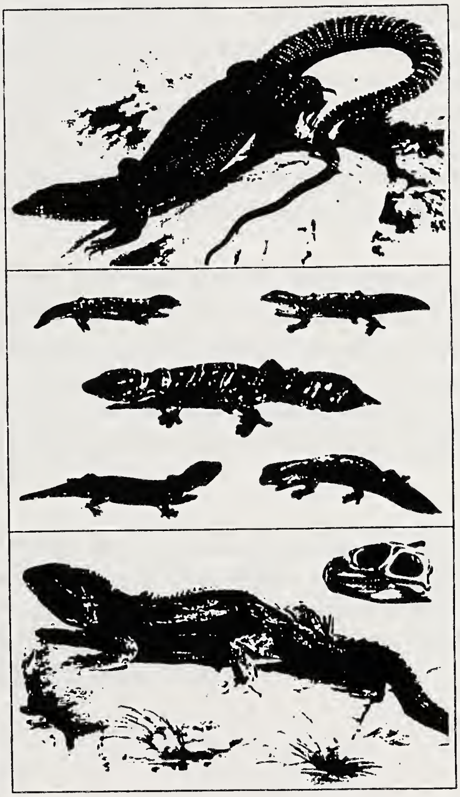

Society Publication

Back issues of the Bulletin of the Maryland Herpetological Society, where available, may be obtained by writing the Executive Editor. A list of available issues will be sent upon request. Individual numbers in stock are $2.00 each, unless otherwise noted.

The Society also publishes a Newsletter on a somewhat irregular basis. These are distributed to the membership free of charge. Also published are Maryland Herpetofauna Leaflets and these are available at $.25/page.

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All correspondence should be addressed to the Executive Editor. Manuscripts being submitted for publication should be typewritten (double spaced) on good quality 8 1/2 by 11 inch paper with adequate margins. Submit original and first carbon, retaining the second carbon. If entered on a word processor, also submit diskette and note word processor and operating system used. Indicate where illustrations or photographs are to appear in text. Cite all literature used at end in alphabetical order by author.

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Natural History Society of Maryland, Inc.
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DEPARTMENT OF HERPETOLOGY

THE NATURAL HISTORY SOCIETY OF MARYLAND, INC.

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30 JUNE 1995 **VOLUME 31 NUMBER 2**

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BULLETIN OF THE MARYLAND HERPETOLOGICAL SOCIETY

Volume 31 Number 2 June 1995

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The Maryland Herpetological Soceity
Department of Herpetology, Natural History Society of Maryland, Inc.

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Meetings

The third Wednesday of each month, 8:15 p.m. at the Natural History Society of Maryland (except May—August, third Saturday of each month, 8:00 a.m.). The Department of Herpetology meets informally on all other Wednesday evenings at the NHSM at 8:00 p.m.

BIOLOGICAL AND SYSTEMATIC SYNOPSIS OF A GENUS OF FROGS FROM NORTHERN MOUNTAINS OF SOUTH AMERICA (ANURA: DENDROBATIDAE: MANNOPHRYNE)

Enrique La Marca

A biological and systematics synopsis is provided on species of the dendrobatid frog genus *Mannophryne*. An analysis of characters was undertaken comprising osteological characters (cranial osteology, vertebral column elements, limb elements), pectoral girdle and hyolaryngeal skeleton, and non-osteological characters like myology (mandible depressor musculature, mandible adductor musculature, intermandibular musculature, and thigh musculature), karyology, behavior (aggressive and courtship), amplectic position, collar morphology, scute morphology, and tadpoles. An analysis of characters was performed, polarizing the characters by means of outgroup comparisons and ontogenetic transformations, to ascertain phylogenetic relationships among the species in the genus.

Se presenta una sinopsis de la información biológica y sistemática sobre las especies que comprenden el género de ranas dendrobátidas *Mannophryne*. Se llevó a cabo un análisis de atributos tales como caracteres osteológicos (cráneo, columna vertebral, elementos de las extremidades)., cintura escapular u esqueleto hiolaringeo, y caracteres no osteológicos como miología (musculatura intermandibular, y musculatura del muslo), cariología, comportamiento (agresivo y de cortejo), posición amplectante, morfología del collar, morfología de los escudetes dérmicos, y renacuajos. Para el análisis cladistico se polarizaron los caracteres, por medio de comparaciones con grupos externos y transformaciones ontogenéticas, con la finalidad de elucidar las relaciones filogenéticas entre las especies.

Introduction

The Dendrobatidae is one of the major anuran taxa in the Neotropics. The most recent listing of frog species in the world (Frost, 1985; Duellman, 1993) includes about 170 species in this large family, and new species are being constantly added. Dendrobatids ar distributed from Nicaragua and Tobago south to Bolivia and Southeastern Brazil, and currently arranged into the genera *Allobates* Zimmermann and Zimmermann (considered to be synonym o *Epipedobates* by Myers et al.), *Aromobates* Myers et al., *Colostethus* Cope *Dendrobates* Wagler, *Epipedobates* Myers, *Mannophryne* La Marca *Minyobates* Myers, *Nephelobates* La Marca, 1994, *Phobobates* Zimmermann and Zimmermann (considered to be a synonym of *Epipedobates*) and *Phyllobates* Bibron *in* Sagra. The aims of this paper are to review the available information, and to add new data on the biology and systematics of *Mannophryne* species.

The genus *Mannophyryne* is constituted by nine species *Mannophryne collaris* (Boulenger, 1912); *M. herminae* (Boettger, 1893); *M neblina* (Test, 1956); *M. oblitterata* (Rivero, 1984); *M. olmonae* (Hardy 1983); *M. riveroi* (Donoso-Barros, 1964); *M. trinitatis* (Garman, 1887); *M yustizi* (La Marca, 1989), and a new taxon to be described elsewhere. Al of them share a suit of characters (namely, dark collar, yellow throats and elaborate behavior) that have been hypothesized to support the monophyly of the taxon (La Marca, 1992: 32).

Materials and Methods

Cleared and stained specimens were prepared for all the species of *Mannophryne*, in addition to several other species of dendrobatids Most of this material was stained with alizarin red, cleared with potassium hydroxide and finally stored in glycerin. Some specimens were double stained for cartilage and bone, following the method o Wassersug (1976). Some dry skeletons, were also studied. A complete list of all the specimens examined for this study (stating nature of the specimens if different from wet-stored animals), is found in La Marca (1984). For examination of dorsal scutes, toe tip samples were taken from the fourth toe of specimens kept in 75% ethyl alcohol. Samples were dehydrated in increasing series of ethyl alcohol and critical point dried in CO_2. Samples were coated with approximately 300 - 400 Ä o gold-palladium metal in a Hummer sputter coater. Specimens were examined in a Cambridge S4-10 Scanning Electron Microscope operated at 9 Kv, and photomicrographs taken at a magnification of 55x.

Drawings were made under a Wild M5 microscope with a camera lucida attachment. Photographs of collar patterns were made with a 55 mm macro lens. Drawings and photographs were made with specimens submersed in alcohol, a procedure found to enhance the contrast of patterns.

Terminology employed here is borrowed from different sources as follow: external morphology and vocalization, Duellman (1970); osteology, Tureb (1973); hind leg muscles, Ecker (1889); throat muscles, Tyler (1971); jaw musculature, Starrett (1968); and hyolaryngeal apparatus, Trewavas (1933). Staging of tadpoles was done according to Gosner (1960). Museum acronyms conform to Leviton et al. (1980), except for ULABG that stands for the herpetological collection at the Instituto de Geografía, Universidad de Los Andes at Mérida, Venezuela.

Analysis of Characters

Osteology

Cranium. The skulls of members of the genus *Mannophryne* are remarkably similar. Fig. 1 depicts a "typical" cranium in the genus. Skulls are wider than long, about one-half as deep as long, lacking dermal ornamentation, and with a moderately ossified neurocranium.

Nasals are moderately large and widely separated medially. The largest nasals are those of *M. collaris*. In *Mannophryne collaris* and *M. olmonae* the nasals slightly overlap the anterior portion of calcified sphenethmoid. Degree of overlapping is minimal in *M. olmonae*. Nasals of *M. neblina* are broadly crenulate anteriorly, a condition not seen in any other skull of the genus. Maxillary processes of nasals are moderately sharp, not articultated with preorbital process of the *pars facialis* of the maxillary; shortest in *M. yustizi*, longest in *M. olmonae*.

Sphenethmoid usually extends to the middle of nasals. Anterior part of sphenethmoid, cartilaginous. Frontoparietals posteriorly overlying the anterior part of otoccipital. Orbital edges of frontoparietal straight. Frontoparietal medially divided along complete length in *M. neblina* and *M. yustizi*. In all other species, frontoparietals are extensively, but not completely divided, except in *M. riveroi*, that possesses only a shallow notch anteriorly. Cristae paroticae well developed, long and narrow. Occipital condyles widely separated.

Otic ramus of squamosal not articulating with distal end of otoccipital. Medial ramus of pterygoid not in contact with ossified portion of prootic region; anterior ramus in long contact with *pars dentalis* of the maxillary bone. Quadratojugals slender, articulated with posteri end of maxillary. Maxillary and premaxillary bearing short teet Maxillae slender, lacking postorbital processes; *Pars palatina* narro slightly wider than *pars facialis.* Alary processes of premaxillary narro curved posterolaterally. *Pars palatina* of premaxillary broadly U-shape Vomers very small, with slender lateral processess surrounding later and anterior parts of choanae. Palatines slender, not expanded distall Parasphenoid T-shaped, lacking dermal modifications; *alae* acuminat directed slightly posterolaterally; length of cultriform process abo twice the width of *alae.* Anterior edge of parasphenoid overlying bo portion of sphenethmoid, usually bearing bifid projections. Columel slender, in broad contact with posterodorsal tympanic membrane.

Vertebral Column. Eight procoelus imbricate presacr vertebrae in all species of the genus; no vertebrae are fused. Cervic cotyles widely separated; cervical cotylar arrangement type I (Lync 1971). Neural spines short, decreasing progressively from anterior posterior part of vertebral column. Largest transverse processes presacral III, followed by presacrals IV and II; transverse processes presacral V and VIII about same size and width; transverse processes presacrals IV to VIII directed anteriorly; processes of presacral V directed laterally, those of presacrals V and VI directed slight posteriorly.

Sacral diapophyses rounded. Ilia not extending anteriorly beyon sacral articulation - except in *Mannophryne herminae, M. neblina* and *trinitatis,* in which ilia may also extend anteriorly to sacral diapophyse Coccyx with narrow dorsal ridge. Sacro-coccygeal articulatio bicondylar.

Limb elements. Phalangeal formula of hand 2-2-3- Prepollical element weakly ossified, slender (Fig. 2), conspicuous in a species except *M. olmonae.* Phalangeal formula of foot 2-2-3-4- Terminal phalanges T-shaped.

Pectoral Girdle. Pectoral girdles firmisternal. Omosternu and xiphisternum present. Clavicles slender, slightly curved to almo straight. Coracoids moderately robust, equal to or larger than clavic (Fig. 3). Scapulae distally bifurcate in all species, albeit le conspicuously in *Mannophryne riveroi,* in which the cartilaginous end greatly calcified. Pectoral girdles of *M. trinitatis* and *M. riveroi* we illustrated by Barbour ad Noble (1920: Fig. 1), and Donoso-Barr (1964: Fig. 5), respectively.

Hyolaryngeal Skeleton. Knowledge on the hyoid and laryngeal apparatuses of dendrobatid frogs is restricted to only three species. The hyolaryngeal apparatus of *Dendrobates tinctorius* was described and figured by Trewavas (1933), while those of *D. histrionicus* ad *D. tinctorius* were figured by Silverstone (1975), and that of *Aromobates nocturnus* by Myers et al (1991). Silverstone (1975) asserts that the variation in the hyoid apparatus of dendrobatids is minor, but a discussion is lacking. By comparing his drawing of the hyoid plate of *D. tinctorius* with that of Trewavas for the same species, it can be seen that the specimens differ in the shape of the alary and anterior processes of the hyoid plate. Only the hyoid of *Mannophryne collaris* was examined for the present work (Fig. 4). It differs from those of *D. histrionicus* and *D. tinctorius* in being (like that of *Aromobates nocturnus*) wider than long (as opposed to longer than wide), and in the shape of the anterior processes (curved in *A. nocturnus, M. collaris,* and in the *D. tinctoruis* depicted by Trewavas; straight in *D. histrionicus* and *D. tinctoruis* depicted by Silverstone). It remains to be seen whether these differences are of importance in dendrobatid classification. Other characters of the hyoid apparatus of *M. collaris,* like the hyoglossal sinus, processes of the hyalia, and posterolateral and posteromedial processes, are similar to those of *D. histrionicus* and *D. tinctorius.*

Non-Osteological Characters

Myology

Depressor Musculature. The *depressor mandibulae* appears to be comprised of three slips: a deep and concealed slip attached to the otic ramus of the squamosal and to the distal end of mandible, a few fibers originating on the posterior edge of tympanic annulus and inserting also at the end of mandible, and a large superficial slip originating on the *fascia dorsalis* and attached to ventral ends of squamosal and quadratojugal. This massive superficial slip of the *depressor mandibulae* conceals a deeper slip, and most part of the fibers attached to the tympanic annulus. It also conceals the posterodorsal edge of the tympanum, a condition considered a dendrobatid synapomorphy by Myers et al. (1991). The shape and details of the *depressor mandibulae* of *Mannophryne riveroi* depicted by La Marca (1984: Fig. 11) are similar to that of *Aromobates nocturnus* illustrated for *Aromobates nocturnus* in Myers et al (1991: Fig. 5). According to Starret's (1968) terminology, the condition of the depressor musculature exhibited in *Mannophryne* can by described as $\mathrm{DFSQ_dAT}$. It is constant in all th species examined, and seems characteristic of the Dendrobatidae.

Adductor Musculature. The *adductor mandibulae externi superficialis* is absent in all the specimens examined. The *A. m. posteri subexternus* originates from the zygomatic ramus of the squamosal an inserts on the posterolateral face of the mandible, anteriad to th mandibular ramus of the trigeminus nerve (V_3). The *A. m. externi lateralis* originates from the quadratojugal and inserts on the lower end c the squamosal, and is situated posterior to the V_3. The *A. m. posteri articularis* originates on the ventral ramus of squamosal and inserts o the quadratojugal, posteriorly to the insertion of the *A. m. externi lateralis*. The *A. m. externus longus* arises on the prootic and inserts at th distal end of the jaw.

Intermandibular Musculature. The *submentalis* is c moderate size and araphic in all the species. The *intermandibularis* runs a a thin sheet of muscle with lateral attachments from the *submentalis* t posterior end of throat, with supplementary elements of the anterolatera type attached upon the ventral surface of the *submentalis*. Th *interhyoideus* is usually not well developed, lacking folds and pleats. Th visibility of the *geniohyoideii* through the median aponeurosis of th *intermandibularis* varies in the species of the group. Table 1 summarize the variability observed.

Thigh Musculature. Griffiths (1959) figured the thig musculature of *Mannophryne trinitatis*, illustrating the classical "ranoi pattern" (i.e. the tendon of the *semitendinosus* lying dorsally to the *gracili major*). Silverstone (1975) noticed that the condition in dendrobatids i unlike that of ranids in that the distal tendon of the *semitendinosus* pierce that of the *gracilis major*. Examination of the thigh musculature of *M collaris, M. herminae, M. riveroi* and *M. trinitatis* confirms Silverstone' observations.

Karyology

Karyotypes of *Mannophryne* are only known for *M. herminae* although Dixon and Rivero-Blanco (1985: 184) mentioned havin secured karyotypes (not described in their paper) of *herminae* (fron another population) and *oblitterata*.

Chromosome Numbers. The chromosome number for *M. herminae* (as "*Colostethus trinitatis*") was reported by Rada (1976) as 2N = 24. This number is similar to that indicated for other dendrobatid species in the genera *Colostethus, Phobobates,* and *Phyllobates,* such as *C. inguinalis* [Duellman, 1967], *P. trivittatus* [Bogart, 1970a, as *Phyllobates* "x"], and *Phyllobates lugubris* [Rasotto et al., 1987]. Also, Bogart (1973) reported of "several" other species of *Colostethus* and *Phyllobates* having 24 chromosomes.

In comparison to *Mannophryne, Dendrobates* have a smaller number of chromosomes. Bogart (1973, 1977) reported 18 or 20 chromosomes for the latter. Published reports indicate 18 chromosomes for *Dendrobates auratus* [León, 1970; Rasotto et al., 1987], and 20 chromosomes for *D. pumilio* [Duellman, 1967; Bogart, 1970a, as *D. typographus*], *D. granuliferus* and *D. pumilio* [Rasotto et al., 1987]. Reduction in chromosome numbers may be indicative of karyotype specialization (Bogart, 1970b). It is generally accepted that primitive members of anuran taxonomic groups usually have higher chromosome counts than do more advanced ones (Lynch, 1971). In this regard, the karyotype of *M. trinitatis* would therefore be primitive with respect to that of *Dendrobates,* which might be considered to have the most specialized karyotype within the Dendrobatidae. In contrast, it might be considered advanced if we compare this number with that of the Elosiinae, regarded the stem group of the Dendrobatidae by Lynch (1971). The chromosome number for elosiines is 2N = 26, as reported for *Crossodactylus gaudichaudii* [Bogart, 1970b], *C. grandis* [Morescalchi, 1973], *Hylodes aspera* [Brum-Zorrila and Saez, 1968], and *H. lateristrigata* [Morescalchi, 1973].

Behavior

Courtship of dendrobatid frogs is the most elaborate among those reported for any anuran (Wells, 1977). The most elaborate behavioral patterns occur in members of the genus *Mannophryne,* with the possible exception of *Colostethus palmatus,* a Colombian species that is probably the sister group of *Mannophryne.* Courtship and aggressive behavior have been reported for *M. collaris, M. herminae,* and *M. trinitatis* (Test, 1954, 1963a, b; Sexton, 1960; Dole and Durant, 1974, 1975; Durant and Dole, 1975; Wells, 1980a). Behaviors in these species differ from those reported for many other dendrobatids in that females are more aggressive than males, and that the latter do not use close-range (tactile) stimuli to lead females to oviposition sites but rather employ elaborated long-distance (vocal and visual) displays (Wells, 1980a, b), The different facets of courtship and aggressive behavior in *M. collaris, M. herminae,* and *M. trinitatis* are very similar. Figures 5 and 6 summarize the main components of the elaborate behavioral repertoire of the species in the genus.

Aggressive Behavior. Females of the three species studied are known to be highly aggressive and more territorial than males. It is interesting that this situation is reversed to that seen in many other dendrobatids. Wells (1980a) hypothesized that parental care may be related to this difference in behavior. Since transport of tadpoles in these collared frogs is carried out exclusively by males (with the possible exception of *M. neblina* - see below), females may engage more freely in close contact attacks that could otherwise be harmful for transported larvae. Females usually occupy shores or elevated positions on rocks in a stream. The number of adult females on a rock, as confirmed experimentally by Sexton (1960), seems to be in direct correlation to the number of crevices in the rock. Such crevices usually enable juveniles to escape aggressive contact with adults, but the latter may also use the crevices when disturbed or to avoid predation. Females of *M. trinitatis* are known to defend fixed territories for more than a month (Wells, 1980a), while those of *M. herminae* defend their territories for at least two months (Sexton, 1960). Estimated female's territory size averages 1.07 sq. ft. for *M. herminae* (Sexton, 1960), 0.6 m^2 for *M. trinitatis* (Wells, 1980a), and it has been stated to be no more than 0.30-0.40 m in diameter for *M. collaris* (Dole and Durant, 1975).

Females of the three above mentioned species usually attack any individual intruding their territories. The aggressive behavioral display starts with the female facing the intruder, adopting an upright posture (cf. Fig. 1A *in* Wells, 1980a) and slowly pulsating the bright yellow throat. The intruder frequently retreats after this challenge. If the intruder does not retreat, the resident female hops to the intruder and repeats the throat challenge. If this also fails, the resident female jump at the intruder, landing directly on the opponent's head (Test, 1954; Sexton, 1960; Dole and Durant, 1974, 1975; Durant and Dole, 1975; Wells, 1980a). If the intruder still resists, the resident female engages in a brief pushing match or wrestling bout, in which both the resident and the intruder stand on their hind legs, leaning against and attempting to push each other off the rock. In *M. trinitatis,* the opponents place their chins together, forcing the other frog back and forth until one of them falls from the rock on which the encounters usually takes place. The opponents may also engage in wrestling bouts, in which both the resident and the intruder stand on their hind legs, leaning against and attempting to push each other off the rock. In *M. trinitatis*, the opponents may use the forelegs for grappling, while engaging in these upright fightings (Wells, 1980a). In *M. herminae*, the frogs extend laterally their forelegs, at more or less right angles to body axis (Sexton, 1960), whereas in *M. collaris* the forelegs are stiffened - although no indication of their position was given (Durant and Dole, 1975; Dole and Durant, 1975). Contrary to the situation in *M. herminae* and *M. trinitatis*, a wrestling bout involving just female-female interactions have not been observed in *M. collaris*.

In *M. trinitatis* and *M. herminae*, male-female wrestling have not been reported, but it occurs in male-female encounters of *M. collaris* (Dole and Durant, 1975; Durant and Dole, 1975); sometimes, female opponents of these species may engage in wrestlings involving clasping the other around the head, like in *Mannophryne trinitatis* (cf. Fig. 1B in Wells, 1980a). Aggressive interactions between *M. trinitatis* males are similar to those involving just females (Wells, 1980a). Wrestling bouts between males have not been reported for *M. herminae* or *M. collaris*, male-male encounters are usually started with some kind of threat by one of the males, although in 69% of male-male encounters studied, the intruder was attacked by the resident male without any preliminary threats (Durant and Dole, 1975). Males of the three species studied do not seem to pulsate the throats in the manner characteristic of females. Males also appear to be less aggressive than females, and it has been suggested, at least for *M. trinitatis*, that males do not fight to defend territories against all intruders but rather fight with potential reproductive competitors (Wells, 1980). Because it is unlikely that a parent frog transporting larvae can defend a territory (Wells, 1980, 1981; La Marca and Mijares, 1988), the purported case of female larval transport in *Mannophryne neblina* (see Table 2) may indicate that aggressive behavior may be absent, or at least less pronounced in females of this species.

Males of *M. trinitatis* seem to use rapid color change, from brown to black, for visual communication (Wells, 1980a). The same appears to be true for *M. herminae*, and *M. collaris* (pers. obs.). Brown coloration in males seems to deter attack by black males, as evidenced by the little incidence of aggression from black males to juveniles, and the apparent inhibition of agonistic behavior when black males turn brown after a given encounter. In this context, it is interesting to note that tadpole-carrying males are invariable paler than any other males of the same species in most of the specimens examined for the genus *Mannophryne*.

The condition is not restricted to the collared frogs, since tadpole-carrying males of C. *mayorgai* and C. *alboguttatus* are also paler than conspecific males not transporting larvae (pers. obs.). This change in coloration could be related to avoidance of agonistic behavior in the benefit of the larvae.

Courtship Behavior. Courtship behavior is known in detail only for *M. collaris* and *M. trinitatis*. The males of these species usually select high calling-places on rocks, logs, or floating vegetation near the female's territories (Dole and Durant, 1974, 1975; Wells, 1980a). The males usually attract females by jumping up and down, in a courtship that also involves vocalizations accompanied by visual displays (change of color from brown to black). The males of *M. trinitatis* are reported to run quickly in a sideways motion along a rock or log (Wells, 1980a). The males of *M. collaris* may raise their bodies on all four legs in an exaggerated pushup. The males of *M. collaris* slowly approach the females, stopping frequently every 5-8 cm, sitting and calling for 10-15 seconds. Then they lower their heads and body to an almost horizontal position, crawling backwards a few steps and jumping upwards. A variant of this behavior is to assume the exaggerated pushup position after calling, then moving backwards a few steps while turning slightly laterally and then jumping. The males maintain a bipedal position for a few seconds, taking one or two steps towards the female before returning to the sitting position. In some instances, a second jump may follow after the sitting position was reassumed (Dole and Durant, 1974, 1975). Apparently, the jump of *M. collaris* is higher than that of *M. trinitatis* (cf. Fig. 1 in Dole and Durant, 1974, 1975). These visual displays are usually made at a distance from the female, although an instance is known in which a male of *M. trinitatis* followed a female that moved away, eventually making contact with her (Wells, 1980a).

The female's lack of receptivity is expressed in the form of threat displays, or chases with or without contact, in the manner described above for agonistic encounters. The female's receptivity is shown by the female following the male once he turns away after performing calls and dancing. The male leads the female to an ovipositing site - usually a rolled dead leaf in *M. trinitatis*. Displacements to the ovipositing site in couples of *M. trinitatis* is known to have covered from 1 to 3 m (Wells, 1980a). A single example is known for *M. collaris* in which a male lead a female for more than 7 m before reaching the ovipositing place (Dole and Durant, 1974, 1975). Once the female began to follow the male, no further calling or dancing was performed by the leading male.

Courtship behavior in *Mannophryne herminae* was described briefly by Test (1963b). The preliminary courtship behavior of males includes singing, dancing, and "striking color change and modification of body shape". The male sings and dances at intervals when leading the female to the ovipositing site, a behavior unknown for *M. collaris* and *M. trinitatis.*

Amplectic Position. Mating amplexus has not been observed in any species of the genus *Mannophryne,* although it has been reported for other dendrobatids. Weygoldt (1987) pointed out that many *Colostethus* and *Phyllobates* employ a cephalic amplexus. Myers (1987), and Zimmermann & Zimmermann (1988), and Myers (1987) reported the occurrence of cephalic amplexus in *Epipedobates,* and *Minyobates,* respectively. In this kind of amplectic position the female is clasped at or near the head. I found non-cornified swollen structures resembling nuptial pads in *Mannophryne oblitterata* (Fig. 7) that could be used during amplexus. Although of unknown use, this is the first time, to the best of my knowledge, that such structures are reported for the Dendrobatidae.

Collar Morphology. The shape of the collar in the genus *Mannophryne* can be assorted into two categories. The first is that of a solid, or unspotted collar. This condition is exhibited by *M. collaris, M. neblina, M. olmonae, M. riveroi* and *M. trinitatis.* Among these, *M. collaris* may occasionally possess pale flecks in the collar. The second category is that of a reticulate or spotted pattern. This condition is exhibited by *M. herminae, M. oblitterata, M. yustizi* and *M.* sp. (from nr. La Mitisús, Estado Mérida, Venezuela). The collar is usually wide, being relatively narrow only in *M. neblina* and *M. olmonae.* The collar is usually absent, or obscured by the ventral dark coloration, in adult males of the majority of the species. The collar eventually disappears or tends to become less evident in adult males when a dark ventral coloration is achieved. The only known exceptions are *M. oblitterata* and *M. olmonae.*

Development of a collar initiates in the late stages of tadpole's ontogeny. The melanophores that usually are widespread throughout the venter of younger tadpoles become restricted in late stages to the throat and chest. This fine dark stippling becomes more evident as a collar once metamorphosis is completed. The juveniles of both sexes bear this character. The collar of juveniles is solid, even in those species possessing spotted collars when adults. Fig. 8 illustrates the different conditions of the collar of adult females of all species of the genus.

Scute Morphology. A pair of dermal appendages on the dorsal surfaces of digit tips is a characteristic feature of dendrobatid frogs. Outside the Dendrobatidae, dorsal scutes are only found in the myobatrachine, petropedetine ranids and elosiines (Lynch, 1979). Griffiths (1959) considered the dorsal scutes to be glandulo-muscular organs employed for adhesion to the foliage - a claim that has yet to be tested. In a discussion on the occurrence of these structures among anurans, Lynch (1979) concluded that it was premature to assess relationships among the different groups that possess them. Nevertheless, the occurrence of dorsal scutes has served of basis for implicit and explicit statements of relationships among the dendrobatids and the elosiine leptodactylids (e.g. Noble, 1926, and Lynch, 1971; and La Marca, 1984, respectively).

In spite or their apparent distinctiveness and potential source for taxonomic characters, dorsal scutes have not been analyzed for systematic purposes. I examined dorsal scutes of specimens of *Mannophryne* and photographed some of them under a scanning electron microscope (SEM). Figure 9 shows a sample of SEM pictures for species in the genus *Mannophryne*. Intraspecific comparisons of the dorsal scutes reveal some degree of variability that seems to prevent the use of these structures for interspecific comparisons, at least for specimens preserved with formalin or ethanol and stored in ethanol. The only reliable feature seems to be the scute's shape. All the species in the genus have proportionately small scutes, with the exception of *M. cordilleriana* and *M. oblitteratus* (Fig. 9).

In conclusion, dorsal scutes are not very useful characters for taxonomic purposes, at least within the *Mannophryne* preserved and stored under traditional methods. It is quite possible that such delicate structures are affected by preservation techniques. Glutaraldehyde may prove to be a better chemical to avoid a possible distortion of the scutes. Scutes are invariably evident in all species once metamorphosis is completed, however they do not appear until larval stage 42 of Gosner.

Tadpoles. The tadpoles of the species of *Mannophryne* have an oval body and a relatively slender caudal musculature. The spiracle is sinistral and the anus is dextral. The denticle row formula is 2/3; the second upper row and the first lower row are medially interrupted; the upper lips have a wide diastema; the lips usually bear a single row of alternating papillae (*Mannophryne herminae* possesses a double row of alternating papillae on lower lip). Labial papillae are small in all the species, with the exception of *M. neblina*, which possesses relatively large papillae. The beaks vary from poorly to well keratinized and usually bear small serrations on the edges. *Mannophryne neblina* has minute crenulate serrations giving the impression of a smooth beak at quick glance. *Mannophryne riveroi* has an almost smooth upper beak and serrate lower beak, while *M. yustizi* may have large or small serrations on the upper beak and large serrations on the lower one.

The tadpoles are carried on top of the males (Fig. 10), with the possible exception of *M. neblina*, in which the task seems to be performed by the females. Table 2 shows known data on dorsally transported larvae of the genus *Mannophryne*.

Systematics

The genus *Mannophryne* is assigned to the family Dendrobatidae on the basis of a commonly shared-derived apomorphy, namely the presence of paired digit dermal scutes. The occurrence of this character in both dendrobatid and elosiine frogs was interpreted by La Marca (1984b) as an indication of a monophyletic origin for both taxa. I believe that the presence of digit dermal scutes in the African genera *Arthroleptides* and *Petropedetes*, and the Australian genus *Taudactylus*, indicates a close relationship among these taxa, rather than the result of convergence, suggesting that these frogs sharing dermal scutes come from a common Gondwanaland stock.

Mannophryne has, besides the digit dermal scutes, other characters that warrants the current familial position: (1) the firmisternal pectoral girdle, (2) presence of a bony prezonal element, (3) chromosome number of 24 or less, and (4) transport of larvae on the back of an adult frog. Many of these characters also occur in other frog families, but are assumed to be the result of convergent evolution. Following are traits for a preliminary systematic arrangement of the *Mannophryne*.

Analysis of characters. An analysis of characters was undertaken to ascertain interspecific relationships. Such analysis resulted in the hypothetical tree of relationships shown in Fig. 11. A matrix summarizing the distribution of the characters employed to construct this phylogenetic tree is given in Table 3. Characters were considered to be primitive if they were also present in the sister group of the taxon under study, provided that they were homologous characters. Although I hypothesize *Mannophryne* as being more closely related to the genus *Colostethus*, that I consider the sister group of *Mannophryne* (see La

Marca, 1984: Fig. 35). Those characters appearing first in thei ontogenetic developmental sequences were considered to be mor primitive intermediate or terminal states.

Characters and character states. The following is a list o characters, and their respective states, employed in the construction o the hypothetic phylogeny. Characters are indicated by letters, an character states by numbers.

A. Chest markings. The presence of a dark transverse ban on the chest is considered a derived condition (La Marca, 1984a, b 1989). Five states of this character could be recognized: State 0: no colla State 1: narrow collar, uniformly colored; State 2: wide collar withou conspicuous pale markings; State 3: wide collar with pale flecks o spots; and State 4: wide collar with large pale dots.

A solid, narrow collar is present in juveniles of some wide collared species; pale flecks usually antecede pale spots in th ontogenetic changes of some species. These observations suggest that narrow collar is most probably a primitive condition, and the ontogeneti change is hypothesized as showing the trend from primitive to derive conditions. The polarization of characters suggested here is a progressiv series from state 0 (the most primitive) to state 4 (the most derived).

B. Tadpole labial papillae. Papillae on lips of larvae are common feature among dendrobatids. Two conditions are recognized State 0: small papillae; and State 1: large papillae.

Small papillae are widespread among the Dendrobatidae. Th large papillae of *Mannophryne neblina* is a unique condition amon collared frogs, although they are present in some *Dendrobates.* Polarity o character states is uncertain. It is hypothesized that large papillae is th derived condition.

C. Dorsal coloration. Dorsal coloration among dendrobati frogs is highly variable. For our purposes, two states are noted for thi character: State 0: spotted dorsum, and State 1: uniformly colore dorsum.

Among members of the genus *Mannophryne,* state 1 is restricte to *M. neblina,* and is considered a derived state.

D. Posteroventral dark band. Two states are recognized fo this character: State 0: absent; and State 1: present.

A posteroventral dark band is, among dendrobatids, only present in *Mannophryne riveroi*. The condition is regarded, by outgroup comparison, as derived.

E. Throat pattern. Two conditions are seen within the *Mannophryne* regarding distribution of melanophores and exposure of bright coloration on throat: State 0: bright coloration extense; melanophores on lips, absent or restricted to borders of lips; and State 1: Bright coloration reduced; melanophores on anterior part of throat, extensively distributed (see Fig. 34 in La Marca, 1984).

Ontogenetic changes, from extensive to reduced exposure of bright coloration, in some collared species, suggest that state 1 is a derived condition.

Discussion of systematic results. Monophyly of *Mannophryne* is supported by the presence of a dark transverse band on the lower gular region (sometimes extending onto chest), yellow throats and elaborate aggressive and courtship behavior that includes throat displays and toe tip jumpings. Within the genus *Mannophryne*, three other synapomorphies were polarized by ontogenetic changes in the collar pattern. A narrow collar was regarded as the most primitive condition since it is present in early ontogenetic stages of almost all species. A wide collar is exhibited by the majority of taxa within the new genus, with the exception of *M. neblina* and *M. olmonae*. This is a uniquely shared-derived condition of this subset of collared frogs (Fig. 8). The presence of pale flecks or spots on the collar is a further derived condition appearing in latter ontogenetic stages. This condition is exhibited by the subset including *M. collaris, M.* sp., *M. oblitterata, M. herminae*, and *M. yustizi*. A last synapomorphy employed in the construction of this tree is the reduction of the exposed bright yellow throat in females. This condition is exhibited by a polytomous subset including *M. collaris, M.* sp., *M. oblitterata,* and *M. yustizi* (Fig. 8). This is a unique condition brought about by the expansion of melanophores on the anterior part of throat, and regarded as derived based on ontogenetic changes of this chromatic pattern.

In a previous phylogenetic study, based on electrophoretic data, Laukeninks (1980) hypothesized *Colostethus collaris* (=*Mannophryne collaris* of this work) as the stem group of *C. alboguttatus, C. haydeeae, C. leopardalis, C. meridensis,* and *C. orostoma*. The present analysis disagrees with these conclusion. *Mannophryne collaris* is presented in this work as part of a monophyletic assemblage consisting exclusively of collared frogs, the remaining species considered by Laukeninks as derived from *M. collaris* were arranged by La Marca (1984a, 1985b, 1989) in an assemblage named the *Colostethus alboguttatus* group, defined on the basis of a uniquely derived character: the presence of large teeth (see La Marca, 1984: Fig. 35). Members of this group are placed now within the genus *Nephelobates* La Marca (1994a). A useful guide to differentiate morphologically both groups is body shape. Members of *Nephelobates* are "slender" frogs, while *Mannophryne* frogs are usually "stout". Furthermore, the former inhabit higher elevations (above 2000 m, and usually associated with cloud forests), while *Mannophryne* frogs inhabit ecosystems immediately below those occupied by *Nephelobates*. Species of *Nephelobates* and *Mannophryne* can be further differentiated by the presence of more reduced nasals in species of the former genus.

Zoogeographical Considerations

The lack of restrictive hypotheses of relationships for northern South American frogs, along with some unresolved nodes of relationship, precludes a zoogeographical analysis for the genus *Mannophryne*. However, some general patterns of distribution seem worth noting. The evolution of the genus has probably been closely linked to the orogeny of the Andean Venezuelan and Caribbean mountain system of northern South America. Members of the genus are found in the islands of Trinidad and Tobago, the Caribbean coastal system of Venezuela, the mountains of Estado Falcón, and the Andean Cordillera de Mérida, Venezuela. The genus does not extend into the Colombian Andes or the Guyanan Tepuis. Their occurrence in the Sierra de Perijá is unknown, but suspected. The arid Táchira Depression, a low pass about 60 km wide and between 150-950 m high, is the most likely geographic barrier to the extension of the genus into other southern Andean areas. The eight species of the genus (and an undescribed one from Estado Mérida, Venezuela) are largely allopatric in distribution, with the exception of three cases of sympatry in Venezuela: *M. herminae* and *M. neblina* at Rancho Grande, *M. oblitterata* and *M. trinitatis* in the Serranía del Interior, and *M. riveroi* and *M. trinitatis* in the Serranía de Paria, all of them in the Caribbean coastal system (La Marca, 1984). Four closely related species occur in the Venezuelan Andes, (*M. collaris, M. herminae, M. yustizi,* and *M.* sp.) while the remaining species of the genus inhabit mountains of the Caribbean coastal system. Allopatric distributions of some species of *Mannophryne* could have been the result of speciation events that took place during the Quaternary due to orogenic and climatic-vegetational changes; the cases of sympatry could represent dispersal events.

Venezuelan species of *Mannophryne* have been collected in humid and very humid mountain forests (Bosque Húmedo Premontano and Bosque Muy Húmedo Premontano in the classification of Ewel *et. al.*, 1976) that are characterized by an annual average precipitation between 1100 - 2200 mm, and an average annual temperature between 18 - 24°C. These characteristics could be useful predictors of the occurrence of collared frogs in places previously not collected. Trinidad specimens seem to be restricted to the Northern Range of this island, whereas those from Tobago seem to prefer the mountainous areas of this island (La Marca, 1994b).

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Table 1. Degree of visibility of the geniophyoideii muscles in the species of the genus *Mannophryne*. Presence of condition is indicated by an "X".

SPECIES	GENIOHYOIDEII MUSCLES	
	visible	non-visible
M. collaris		X
M. sp.	X[1]	
M. herminae		X
M. neblina		X
M. oblitterata		X
M. olmonae		X
M. riveroi		X
M. trinitatis	X[2]	
M. yustizi	X[3]	

[1] Only visible in posterior part

[2] Completely visible or just visible in anterior part

[3] Only visible in anterior part

Table 2. Dorsal tadpoles in the genus *Mannophryne*. "N" = number of tadpoles carried on the back of specimen; "S" = staging of tadpoles according to Gosner (1960); "M" = male; "F" = female.

SPECIES	CARRIER	SEX	N	S
M. collaris	?BMNH	M	3[1]	unknown
Mannophryne. sp.	ULABG 765	M	5	25
M. herminae	AMNH 70772[2]	?	5	?25
	AMNH 70775[2]	?	12	?25
	KU 167321	M	10	25
	TCWC?	M[3]	4-15[3]	?22-26
	USNM 27802	M	11[4]	unknown
	No number	M[5]	15[5]	unknown
M. neblina	?AMNH 70759[6]	F	9	25
	No number	M[7]	unknown	unknown
M. oblitterata	?TCWC	M[3]	7	25
M. olmonae	No number	M[8]	11-19[8]	unknown
M. trinitatis	No number	M[9]	7-12[8]	unknown
M. yustizi	No number	M[10]	3[10]	unknown

[1] Boulenger, 1895, Plate X, Fig. 4.
[2] Badly dessicated, sex undetermined.
[3] Dixon and Rivero-Blanco, 1901.
[4] Stejneger, 1901.
[5] Rada, 1981.
[6] See text for discussion.
[7] Test, 1956.
[8] Hardy, 1983.
[9] Wells. 1980, Fig. 28; Myers field notes January 1972.
[10] Yústiz, 1979, Figs. 1 -2.

Table 3. Distribution of characters among members of genus *Mannophryne*. (Character states as indicated in text).

TAXON	CHARACTER				
	A	B	C	D	E
M. collaris	3	0	0	0	1
M. sp.	3	0	0	0	1
M. herminae	3	0	0	0	1
M. neblina	1	1	1	0	0
M. oblitterata	3	0	0	0	1
M. olmonae	1	0	0	0	0
M. riveroi	2	0	0	1	0
M. trinitatis	2	0	0	0	0
M. yustizi	4	0	0	0	1

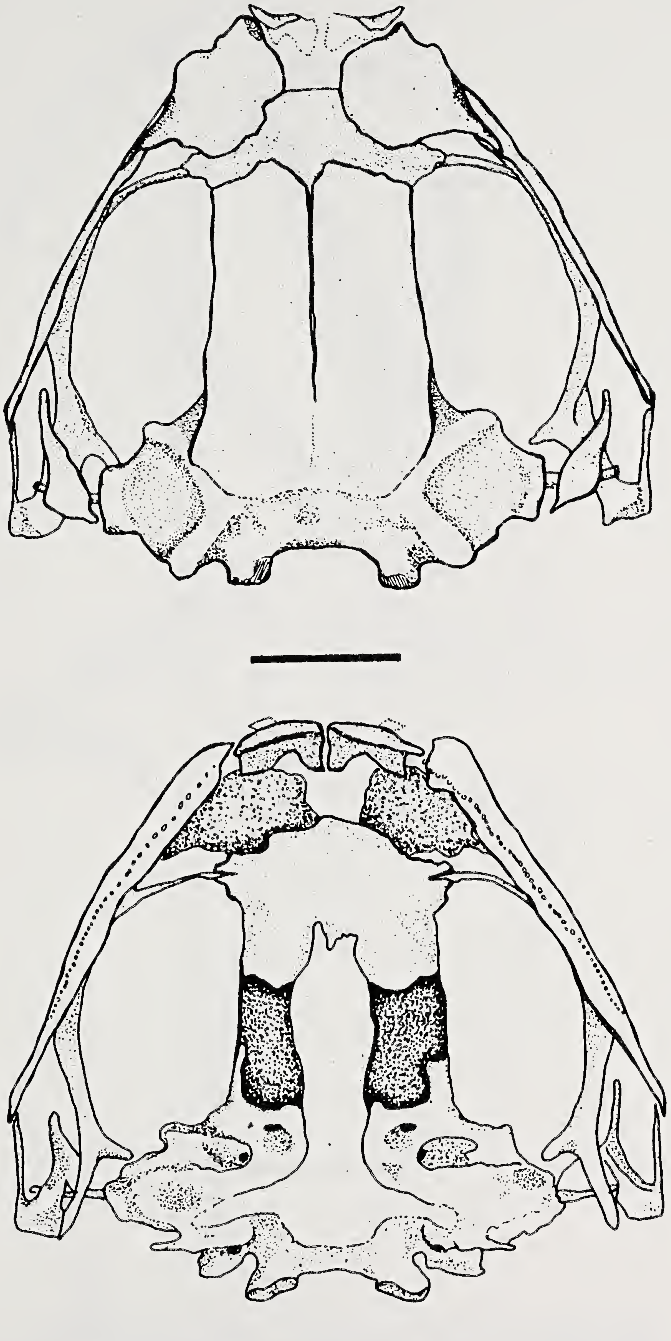

Fig. 1. Skull of *Mannophryne herminae* (KU 133001). Top: dorsal view. Bottom: ventral view. Vomers not shown. Scale equals 2 mm.

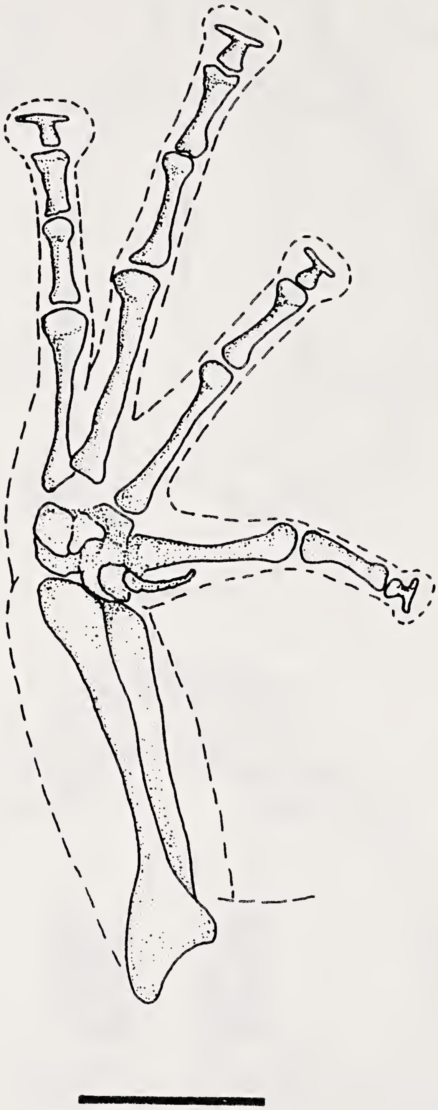

Fig. 2. Osteological elements of the hand and forearm of *Mannophryne trinitatis* (KU 133167). Dashes represent outline of hand and forearm. Scale equals 2 mm.

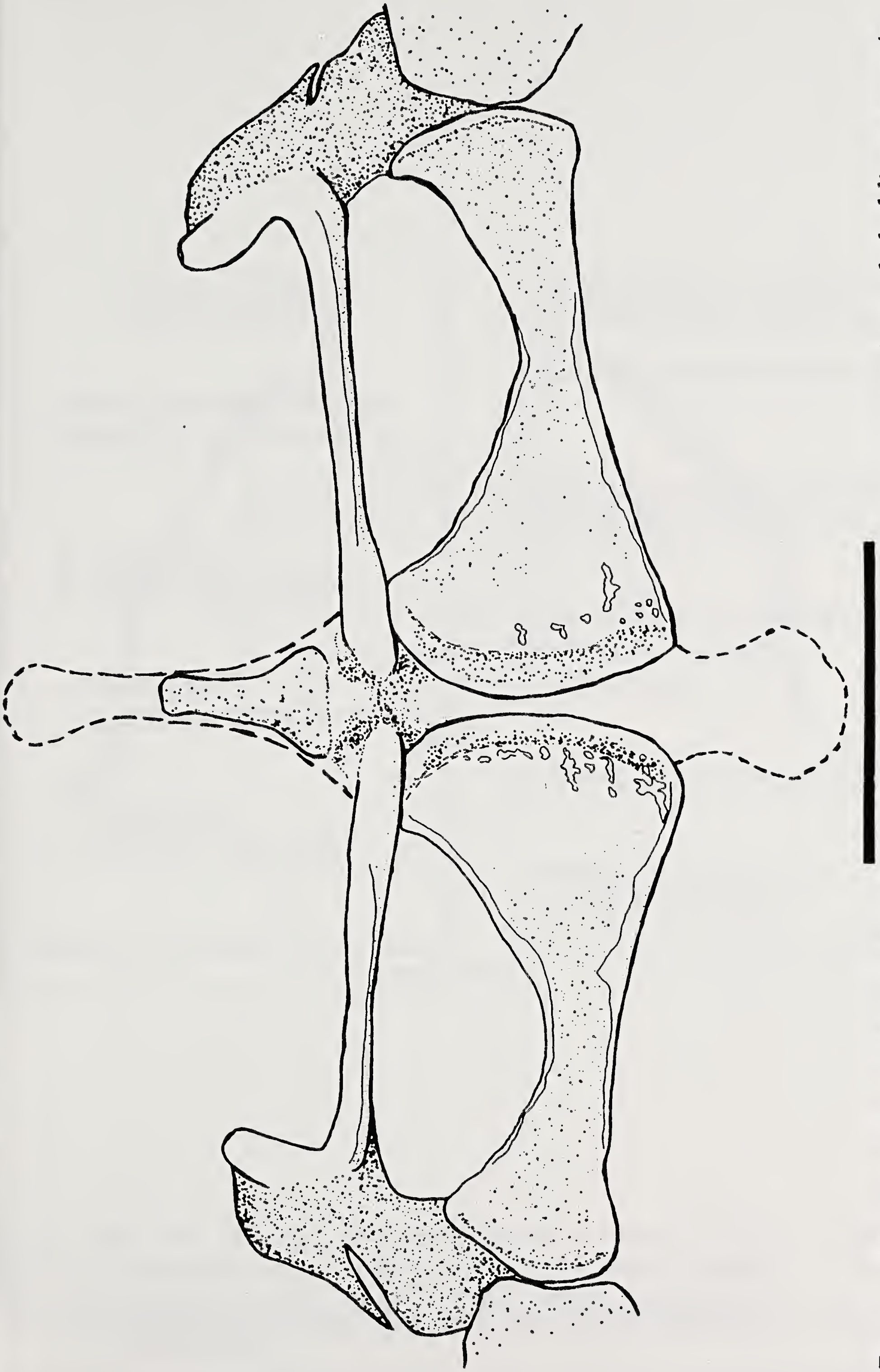

Fig. 3. Pectoral girdle of *Mannophryne collaris* (MCNG 735). Continuous line represents bone, dashed line represents cartilage. Scale equals 2 mm.

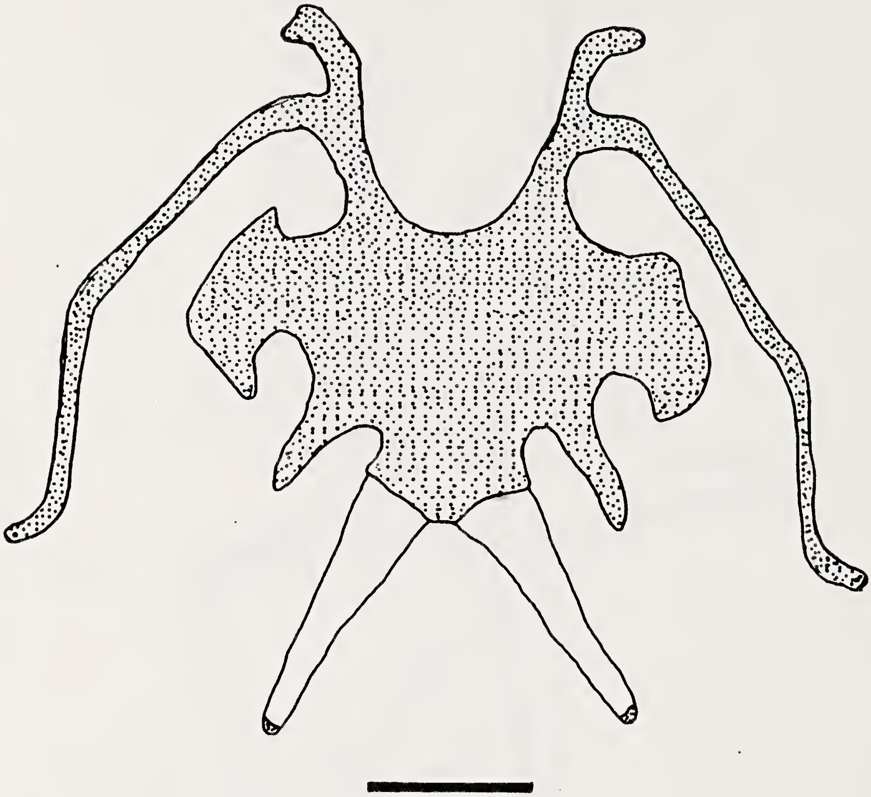

Fig. 4. Hyoid apparatus of *Mannophryne* sp. (ULABG 770, from nr. La Mitisús, Estado Mérida, Venezuela). Largest stippled area is the cartilaginous hyoid plate. Areas without stippling are the posteromedial processes of the hyoid plate. Scale equals 2 mm.

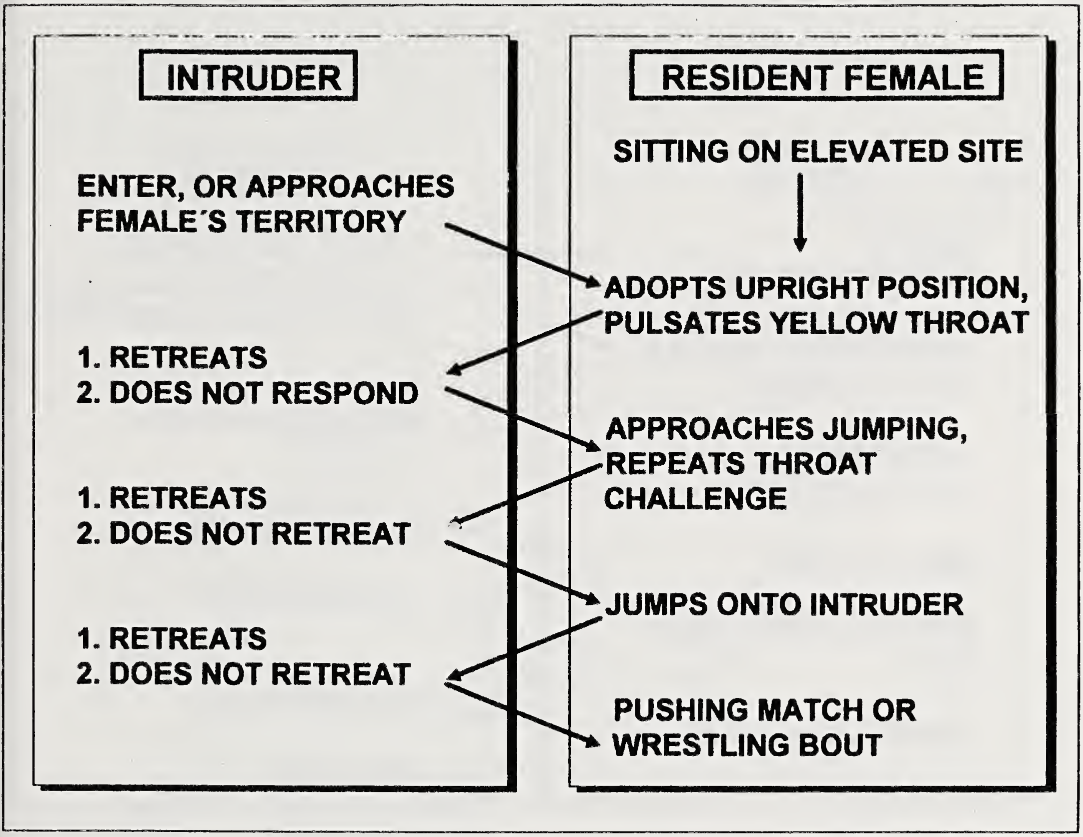
INTRUDER
RESIDENT FEMALE
SITTING ON ELEVATED SITE
ENTER, OR APPROACHES FEMALE´S TERRITORY
ADOPTS UPRIGHT POSITION, PULSATES YELLOW THROAT
1. RETREATS
2. DOES NOT RESPOND
APPROACHES JUMPING, REPEATS THROAT CHALLENGE
1. RETREATS
2. DOES NOT RETREAT
JUMPS ONTO INTRUDER
1. RETREATS
2. DOES NOT RETREAT
PUSHING MATCH OR WRESTLING BOUT

Fig. 5. Summary of stereotyped aggressive behavior in frogs of the genus *Mannophryne*.

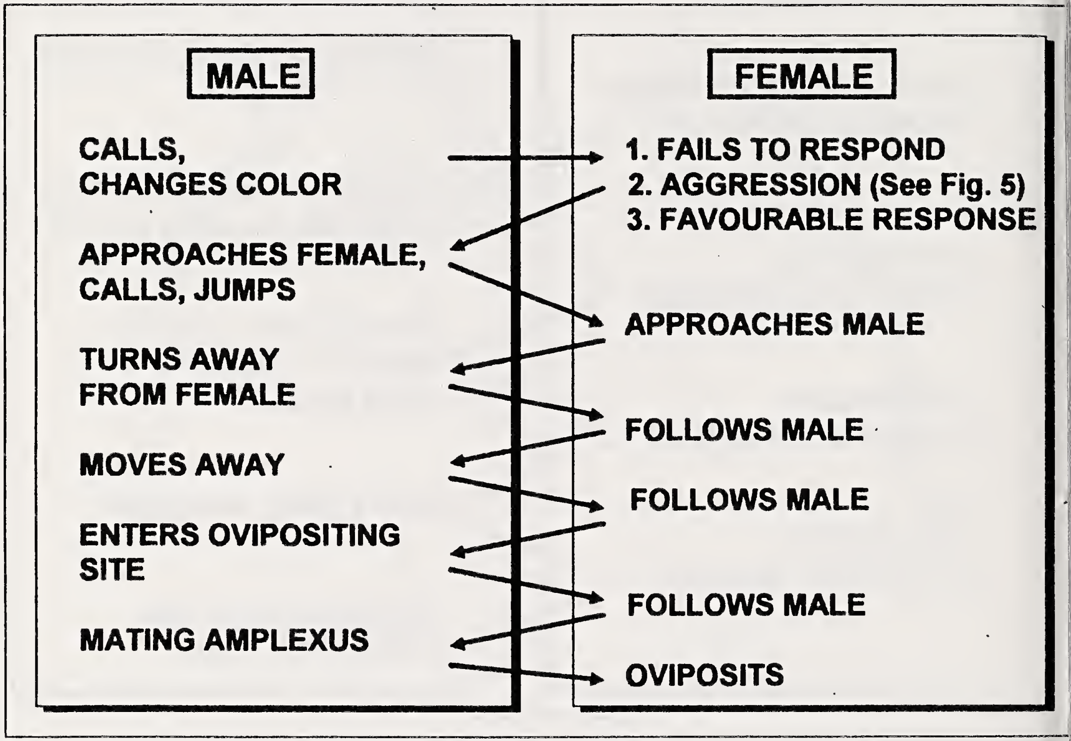

Fig. 6. Summary of stereotyped courtship behavior in frogs of the genus *Mannophryne*.

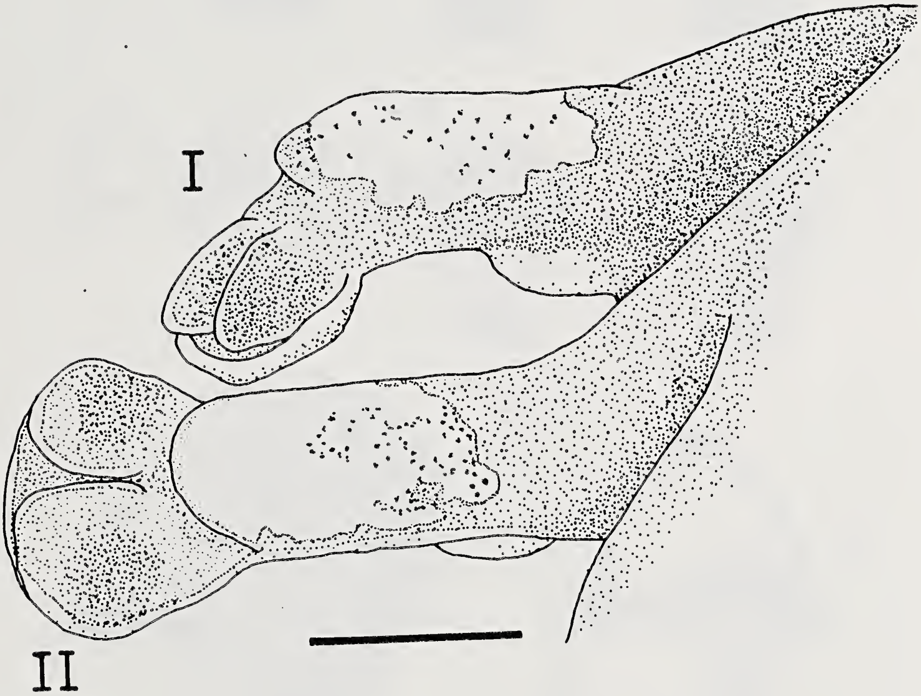

Fig. 7. First (I) and second (II) fingers of left hand of adult male of *Mannophryne oblitterata* (TCWC 61415), showing (in white) swollen structures (nuptial pads?) on dorsal surfaces of those digits. Structures are present on both hands, in similar position. Scale equals 1 mm.

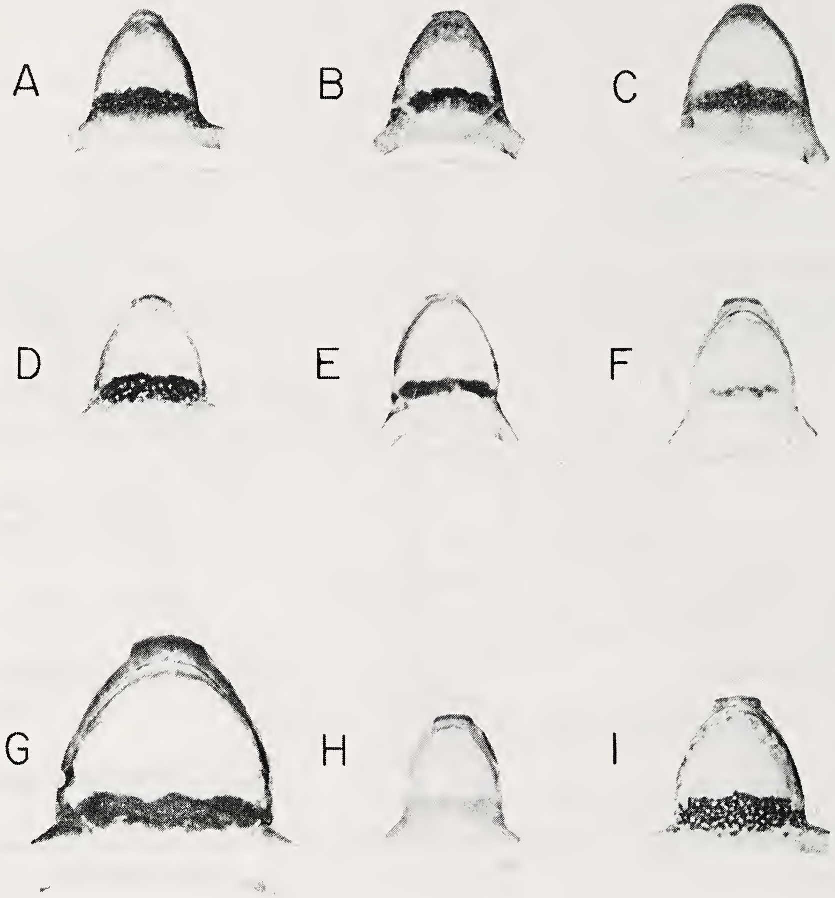

Fig. 8. Throat color patterns in females of the genus *Mannophryne*. (A) *M. collaris*, (B) *M.* sp. (from nr. La Mitisús, Edo. Mérida, Venezuela), (C) *M. oblitterata*; (D) *M. herminae*, (E) *M. neblina*, (F) *M. olmonae*; (G) *M. riveroi*, (H) *M. trinitatis*, (I) *M. yustizi*.

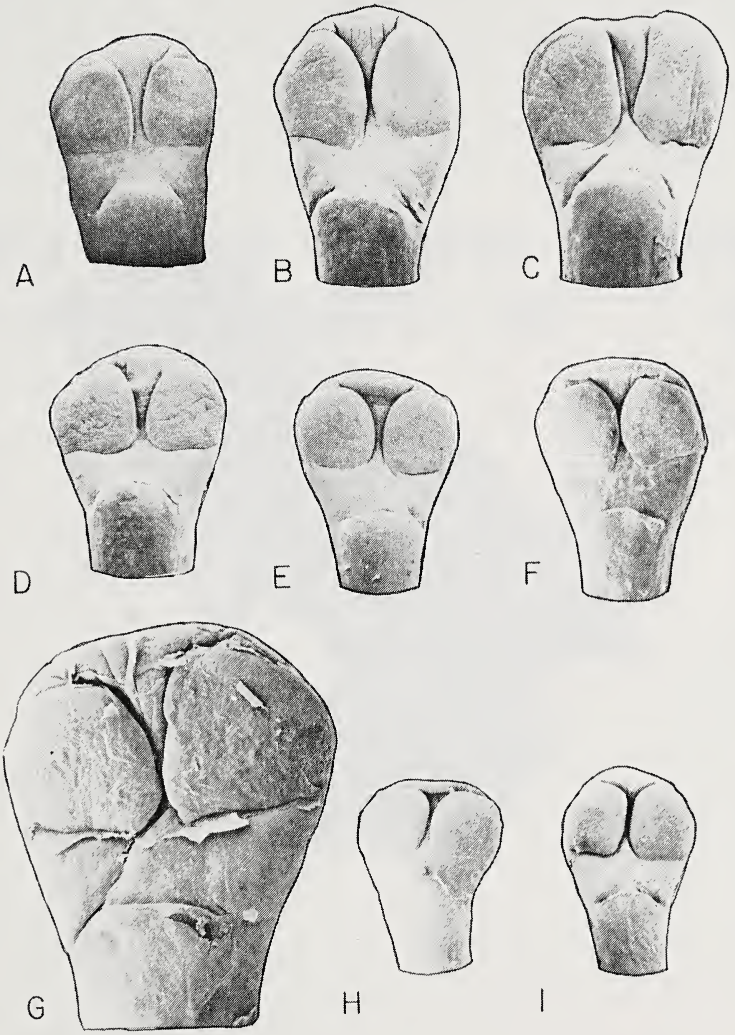

Fig. 9. Scute morphology of *Mannophryne*. (A) *M. collaris* (ULABG 856); (B) *M.* sp. (ULABG 1063), (C) *M. oblitterata* (TCWC 61414); (D) *M. herminae* (UMMZ 122385), (E) *M. neblina* (UMMZ 113015), (F) *M. olmonae* (KU 154416) ; (G) *M. riveroi* (KU 133063), (H) *M. trinitatis* (KU 154435), (I) *M. yustizi* (ULABG 813).

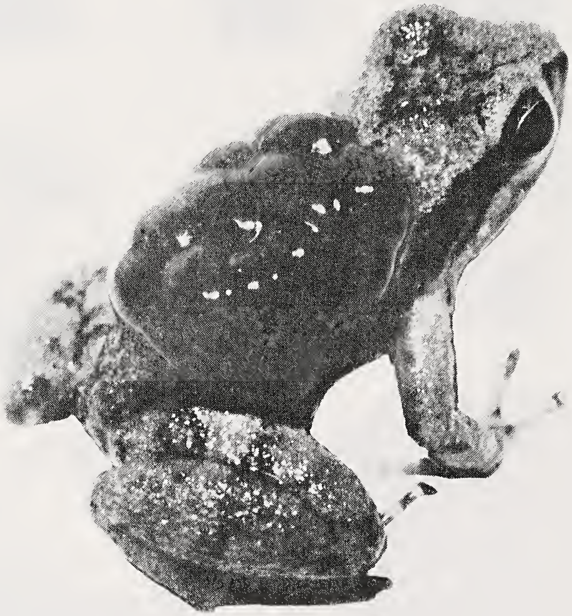

Fig. 10. Male *Mannophryne olmonae* from Tobago [field number C. W. Myers 10846 (1 of 2), deposited in AMNH] showing tadpoles (10?) carried on back. Photo by C. W. Myers.

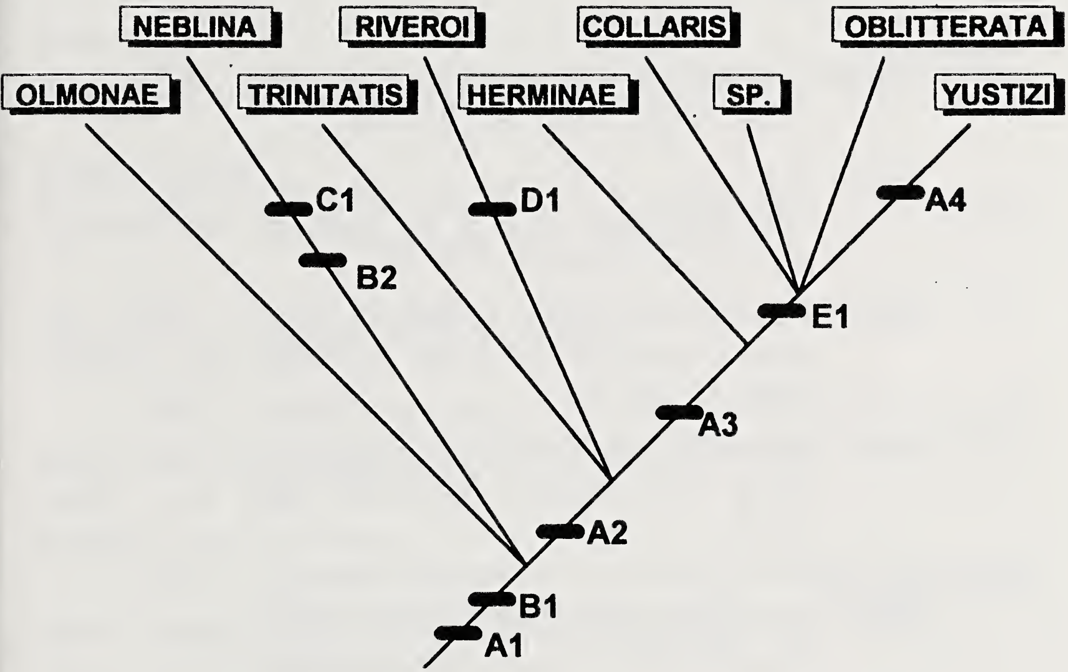

Fig. 11. Hypothetical relationships among species of the genus *Mannophryne*. Letters and numbers correspond to characters and character states indicated in text. Horizontal bars represent hypothesized uniquely derived characters (synapomorphies).

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SOME ASPECTS OF THE ECOLOGY OF TWO SYMPATRIC SIBLING SPECIES, *LEPTODACTYLUS OCELLATUS* (LINNAEUS, 1758) AND *L. CHAQUENSIS* (CEI, 1950) (ANURA: LEPTODACTYLIDAE), IN THE HUMID CHACO OF ARGENTINA

A. Alberto Yanosky[1], Claudia Mercolli[1], and James R. Dixon[2]

Leptodactylus of the *occellatus* group are represented by two species in Argentina. Their sympatry has been reported but no study has focused on the comparative ecology of the two species. *Leptodactylus ocellatus* and *L. chaquensis* occur at El Bagual Ecological Reserve in northeastern Argentina, their populations were surveyed to obtain basic ecological knowledge for the species. Data were obtained from a drift fence system arranged in three major habitat types. A total of 741 specimens, mostly juveniles and females, were captured. Growth curves are given for the first time and size maxima reported. Shrubby savannas appear to be the major habitat type selected by both species. Activity for the species was continuous during the rainy season at El Bagual. Juvenile recruitment appears to be discontinuous and dates of metamorphosed hatchlings are given. Ecological differences between these species are slight. Our data suggest that temporal and spatial segregation may vary little but peak breeding periods appear different. Sit-and-wait feeding strategies occur in both species in syntopic situations. Future research should focus on other dimensions of the niche (such as food items) to evaluate the coexistence of the species at El Bagual.

Introduction

Argentine members of the *L. ocellatus* group are represented by two species, *L. ocellatus* (Linnaeus, 1758) and *L. chaquensis* Cei, 1950 (Cei, 1980). Both species are sympatric in the Argentine provinces of Corrientes, Entre Ríos and Santa Fe (Cei, 1980; Gallardo, 1966) and syntopic in eastern Formosa (Yanosky *et al.*, 1993). Both species are large, *L. ocellatus* the larger with a maximum snout-urostyle length (SUL) of 140 mm for males and 120 mm for females. Both sexes of *L. chaquensis* reach 80-85 mm SUL (Cei, 1980; Gallardo, 1987). *Leptodactylus ocellatus* is terrestrial and commonly found submerged in shallow waters. It is an open area inhabitant, with lentic floating foam nests attached to vegetation and with lentic tadpoles. Calls of this species have been recorded only for December and February at El Bagual, though active in March for Brazilian localities (Cardoso *et al.*, 1989; Duellman, 1989; Heyer *et al.*, 1990). Our knowledge of *L. chaquensis* is poor.

Mating calls as isolating mechanisms have been demonstrated for both species (Barrio, 1966), though other characters on community ecology have not been assessed. The presence of both species at El Bagual Reserve is an excellent opportunity to study anuran behavior, microgeographic segregation, and temporal isolation. [* Anuran studies have examined only partially frog assemblages (Heyer *et al.*, 1990)]. Some ecological segregation are expected to occur between these syntopic and sibling species of *Leptodactylus*.

Materials and Methods

Study Area

El Bagual Ecological Reserve is a 3,463 ha protected area in the Province of Formosa, northeastern Argentina 26° 10′ 53″ S, 58° 56′ 39″ W), within the Humid Chaco biogeographical region. The Humid Chaco is characterized by grasslands and forests with an equilibrium maintained by naturally occurring floods and fires. Climatologically, El Bagual receives 1200 to 2000 mm annual rainfall. The actual amount of rainfall and its timing are highly unpredictable and consequently extreme drought or flooding conditions may occur, most principally during winter and summer, respectively (Fig. 1). Thermally, the annual temperature mode is 17°C (22°C) 27°C (Fig. 1) with extreme temperatures reaching 2°C and 45°C (1988-1994).

El Bagual is characterized by "bañados" (flooded grasslands) interspersed with patches of variable woodland communities. These woodlands were represented by: 1) Grasslands or shrubby savannas (Gr). Most of the grasslands in the reserve were formerly exploited for agriculture and subsequently abandoned; many of these areas have reverted to *Imperata* grasslands. Grasslands are composed principally of *Imperata, Schixachirium, Heimia* and *Solidago*. Few trees (e.g. *Prosopis, Copernicia, Acacia, Enterolobium* and *Tabebuia*) colonize this habitat if flooding and burning are not permitted. These grasslands are rarely flooded, (2) Low forest (Lf). Woody habitat typically 15-17 m high. The canopy layer is composed primarily of *Gleditsia, Aspidosperma,* and *Diplokeleba.* The second layer is composed of *Acacia praecox, Eugenia uniflora* and *Allophylus edulis,* with an ground herbaceous layer dominated by *Bromelia serra* and *Aechmea disticantha.* (3) High forest (Hf). A climax, heterogenous woody formation with a broad specific density, complete canopy and five vegetation layers, the upper one exceeding 20 m in height. The principal canopy is composed of *Tabebuia ipe, Phyllostylon, Enterolobium* and *Ruprechtia.* The fourth layer is dominated by *Diplokeleba, Chlorophora* and *Pisonia.* The third layer contains *Eugenia pungens, Chrysophyllum, Ficus monckii* and *Syagrus.* The fourth layer (shrubby) is composed of *Trichilia, Linociera* and *Sebastiania.* The fifth (ground) herbaceous layer is dominated by *Pseudoananas macrodonthes.* Epiphytic plants such as *Rhipsalis* cacti, *Thillandsia* spp. occur in all strata.

Patches of introduced *Eucalyptus* spp. are fairly widespread in eastern Argentina. The eucalyptus forest forms some woody patches 35 years old that were planted over an *Imperata* grassland to provide timber at El Bagual Ranch, but not in the reserve. Another exotic tree in this habitat is *Melia azedarah,* which may spread because its seeds are widely dispersed by the Toco Toucan (*Rhamphastos toco*) and some species of psittacids.

Field Work

An array of four drift fences was established in three different sites (excluding banados), the high forest, low forest, and grasslands. Each fence 15 m in length, is composed of a plastized cloth wall, buried 10 cm below the surface and 40 cm in height, and with a 5 gallon bucket buried at each end. A metal funnel trap was placed on each side of the fence at mid distance. Each captured specimen was marked with a toe-clip according to Waichman (1992)'s method, and snout-urostyle length (± 0.1 mm) (SUL), sex/age and body mass (± 0.1 g) were recorded. Captured specimens were released near the original place of capture. The sampling period extended from 18 October 1993 through 18 May 1994. Efforts to capture both species in modified habitats (mowed garden) in the vicinity of El Bagual Biological Station were made. Two days per week were dedicated to search for tadpoles in different types of water bodies. Results of drift fence sampling were grouped into weekly intervals (week 1 through week 31). Rainfall measured 1034.2 mm during the sampling period. Adult male *L. chaquensis* and *L. ocellatus* were sexed by the presence or absence of thumb spines.

Results and Discussion

Two hundred and fifty-three *L. ocellatus* and 488 *L. chaquensis* were captured and released at El Bagual. Males were poorly represented in both species, 6.3% (n = 16) for *L. ocellatus* and 8.81% (n = 43) for *L. chaquensis*. The majority of individuals were juveniles, 47.8% in *L. ocellatus* and 62.1% in *L. chaquensis*.

Leptodactylus ocellatus is larger than *L. chaquensis*. Size maxima for *L. ocellatus* was 97.4 mm and a minimum of 20.4 mm. Size maxima for *L. chaquensis* was 77 mm and a minimum of 13.6 mm. In both species, males were larger than females (Table 1). Male thumb spines appeared at 47 mm SUL for *L. ocellatus* and 45 mm for *L. chaquensis*. Males of *L. ocellatus* showed a higher variability of both SUL and body mass than males of *L. chaquensis*. The heaviest animals recorded weighed 76 g for *L. ocellatus* and 36 g for *L. chaquensis*.

Females of *L. ocellatus* showed greater variability than *L. chaquensis* in both SUL and weight. Sixty-two g was the highest weight for *L. ocellatus* females and 38.5 g for *L. chaquensis*. Specimens captured with a lower SUL than that of the minimum length attained by sexually differentiated males were considered to be juveniles in both species. *Leptodactylus ocellatus* juveniles ranged from 20.4 to 49.6 mm SUL and *L. chaquensis* ranged from 13.6 to 45.1 mm SUL.

Body mass versus SUL relationships are given in Table 1 for *L. ocellatus* and *L. chaquensis*. Both species have similar growth curves, though *L. ocellatus* attains a larger size. Hatchlings of *L. chaquensis* are smaller as are the adults (Fig. 1 and 2).

Habitat selection for both species is shown in Figure 3. Both species utilize all habitat types available at El Bagual Ecological Reserve: high forest, low forest, shrubby savannas, and modified habitats. The majority of both species were captured in open areas, 53% of *L. ocellatus* and 51% of *L. chaquensis*. Both species are relatively rare in low forest. *Leptodactylus chaquensis* may be the more synantropic species, with 32% of our capture, in habitats modified by man, while only 13% of *L. ocellatus* occur there. Conversely, *L. ocellatus* has a greater affinity to high forest (34%), while only 10% of *L. chaquensis* occur there. This suggest that *L. ocellatus* has greater tolerance for shaded conditions, less tolerance for disturbed habitats, and the converse is true for *L. chaquensis*. These factors may or may not represent some elements of competitive theory.

A generalized pattern of activity for the sampling period is shown in Figure 4. In general both species were active at the same time, especially in the shrubby savannas (grasslands). Their activity coincided with rainfall periods, but activity peaked after rain periods (Fig. 4). Individuals of either species were not captured during early January (week 12, 13), in agreement with absence of rains. Rains were absent from 28 December to 11 January. During this period *L. chaquensis* was essentially inactive while *L. ocellatus* showed greater activity. Another decrease in rainfall was recorded for 26 April to 03 May towards the end of anuran activity within El Bagual, and neither species were active at this time. It seems that both species require water, high levels of ambient humidity and temperature to remain active.

We assume that the smallest specimens captured represent metamorphosed hatchlings. These hatchlings appeared in our traps at 20 mm SUL (0.7 g) for *L. ocellatus* and 13.6 mm SUL (0.2 g) for *L. chaquensis*. Gallardo (1970) indicated that *L. ocellatus* metamorphed between 16-18 mm SUL in Buenos Aires. No literature data is available for *L. chaquensis*. To determine the general time of metamorphosis of both species at El Bagual, we divided our sample into a "hatchling" age class; *L. chaquensis* <27.15 mm SUL (n = 168, 55.4%) and *L. ocellatus* <34.7 mm SUL (n = 64, 52.9%). We based our assumption of size on the average size of juveniles (Table 1). Based upon this analysis, there are two peaks of reproduction for *L. chaquensis*, early December and the end of February and early March (Fig. 5). The latter period contains 76.78% of the hatchling sample (n = 129) of *L. chaquensis*. The metamorphosis peak for *Leptodactylus ocellatus* hatchlings occurred during at the end of December and the first of February. In general the appearance of metamorphosed hatchlings occur in non-rainy periods (Fig. 5). Based upon this data, *L. chaquensis* breeds in early spring and relatively late summer during their activity season, while *L. ocellatus* breeds in a late spring/early summer period. This suggests that some temporal isolation between respective breeding seasons of these two species.

We found only two groups of tadpoles, one for each species, during the entire sampling period. Both groups were found in an artificial pond associated with a horse and cow pasture near El Bagual Biological Station. The group of *L. ocellatus* tadpoles was found on the night of 16 November 1993. It was comprised of a mass of tadpoles 30 cm in diameter, actively moving and feeding on cattle faeces in shallow water about 3 cm deep. We estimated the number of tadpoles to be about 7000. The group of *L. chaquensis* tadpoles was found on the night

14 February in the same pond (20 m distant) but in water about 30 cm in deep.

We have no indication of diurnal activity of adult individuals of either species. All of our observations were made after dark, especially in the first hours after sunset. We were often about in the grasslands during the day, but failed to observe calling or other activity of adult frogs at this time. Basso (1990) confirmed diurnal activity for *L. ocellatus*. We confirm nocturnal activity for both species at El Bagual.

We did not observe amplexus of either species at El Bagual. Following the first heavy rain occurred by mid-November after a 9-month period of intense drought, *L. chaquensis* was observed calling. If both species bred at this time, the larval development and appearance of metamorphosed hatchlings should have appeared at the same time. We have been unable to distinguish differences between the tadpoles. If growth and metamorphosis of tadpoles are dissimilar between the species, then our assumption of breeding dates suggested by our data presented in Figure 5 may be wrong. If this is true, then the species can not be segregated ecologically, utilizing these variables.

The first sympatry of the species was cited for Uruguay (Vaz-Ferreira *et al.*, 1984). In Central Argentina both species cited by Cei (1956) but specific localities are not given. In specific localities of Entre Ríos, Gallardo (1964) emphasized two allopatric faunas of anurans, somewhere slightly overlapping, but in which case the above species are segregated.

Size maxima for *L. ocellatus* was cited as 76 mm by Cochran (1955) and 78 mm by Hödl (1990) for Brazil and larger sizes for Central Argentina by Cei (1980) and Gallardo (1987). Our records fall somewhere between the size maxima for Brazil and Argentina specimens. Our largest El Bagual specimen of *L. ocellatus* was about 98 mm SUL. Size maxima for *L. chaquensis* at El Bagual of 77 mm SUL is in agreement with the minimum of the range given by Cei (1980) of 80 mm.

Basso (1990) cites *L. ocellatus* as a sit-and-wait stratigest and a food generalist. We have not examined stomachs of either species, but we have observed them "sitting-and-waiting" (contrary to active foraging move) in the vicinity of ponds. Both sexes of both species have been observed together, especially on days following rains. Both species may be well segregated in the trophic niche according to the size of prey taken in response to body size. This needs to be evaluated in the future. While collecting frogs at night all sizes of both *Leptodactylus* species were placed together in the same plastic bag until we returned to the laboratory. On several occasions we found that larger individuals of both species consumed hatchlings and juveniles while together in the bag. This is indicative of an opportunistic consumer.

The adaptation to modified habitats by *L. chaquensis,* to shaded habitats by *L. ocellatus,* and perhaps temporal isolation of breeding periods, are the only indications ecological segregation of these sibling species at El Bagual Ecological Reserve. Further studies should be focused on the trophic niche. This may be the important mode that allows both species to coexist syntopically.

Acknowledgments

We express our thanks to M. Dixon, D. and T. Yanosky, C. Cerdán and J. Moreira for their help in the field. Alparamis S. A. provided financial and logistic support for this project. This is Scientific Contribution, SC # 77 for El Bagual Ecological Reserve, Formosa, Argentina.

Table 1. Summary of snout-urostyle length and body mass in juveniles, females and males of *Leptodactylus ocellatus* and *L. chaquensis* from El Bagual Ecological Reserve, Argentina.

	Leptodactylus ocellatus	*Leptodactylus chaquensis*
	SNOUT-UROSTYLE LENGTH	
Males		
Mean	64.52	58.25
STD	27.85	7.76
CV	43.16%	13.32%
Range	47.2-97.4	45.5-77.0
Sample #	16	43
Females		
Mean	60.52	55.10
STD	12.75	6.59
CV	21.05%	11.96%
Range	49.7-87.1	45.0-77.0
Sample #	116	142
Juveniles		
Mean	34.7	27.15
STD	9.8	7.87
CV	28.24%	28.98%
Range	20.4-49.6	13.6-45.1
Sample #	121	303
	BODY MASS	
Males		
Mean	39.81	19.95
STD	23.78	7.04
CV	59.73%	35.28%
Range	14.0-76.0	8.5-36.0
Sample #	16	43
Females		
Mean	24.87	16.55
STD	12.11	6.32
CV	48.69%	38.18%
Range	10.9-62.0	7.5-38.5
Sample #	116	142
Juveniles		
Mean	5.24	2.72
STD	3.89	2.71
CV	48.69%	99.63%
Range	0.7-14.5	0.2-16.5
Sample #	121	303

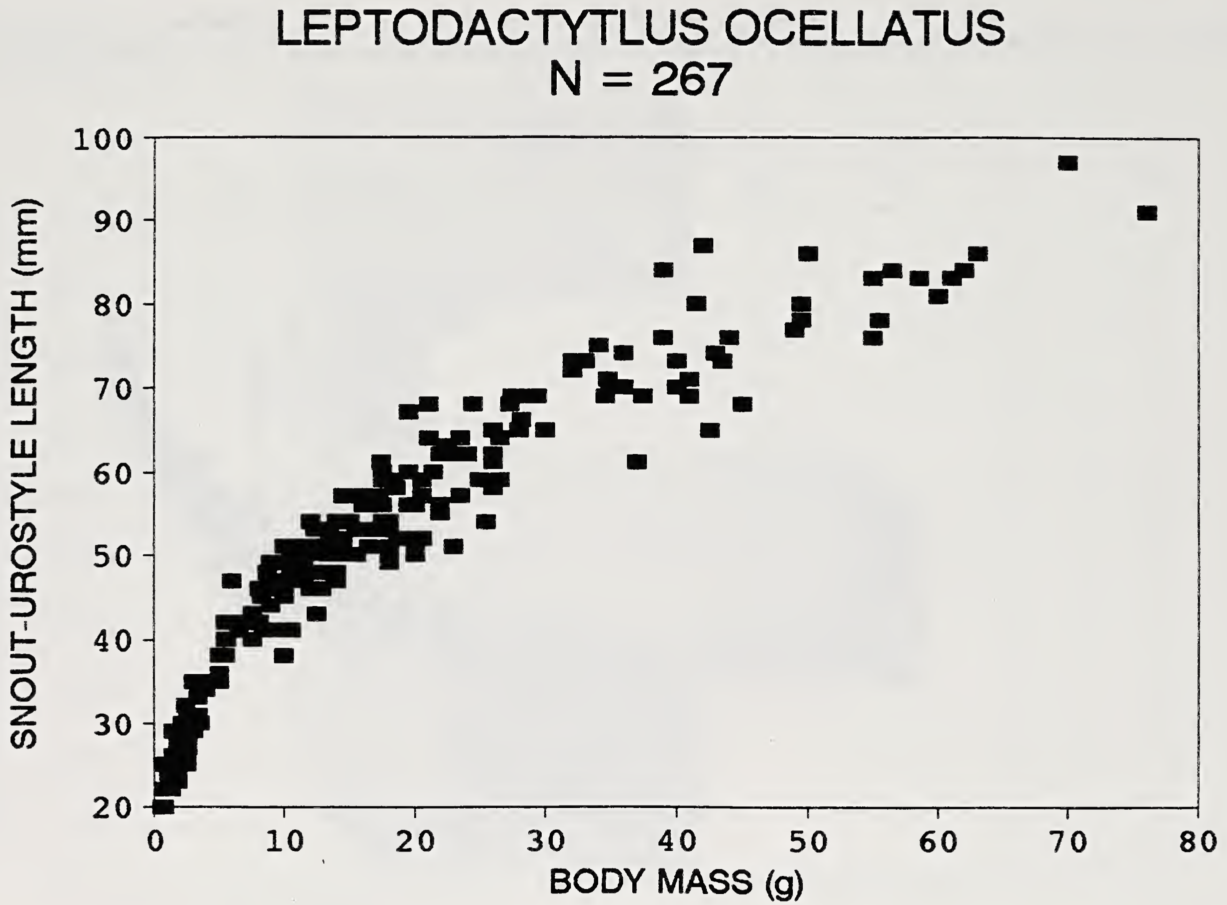

Fig. 1. Snout-urostyle length vs body mass relationships of 267 specimens of *Leptodactylus ocellatus* from El Bagual Ecological Reserve, Argentina.

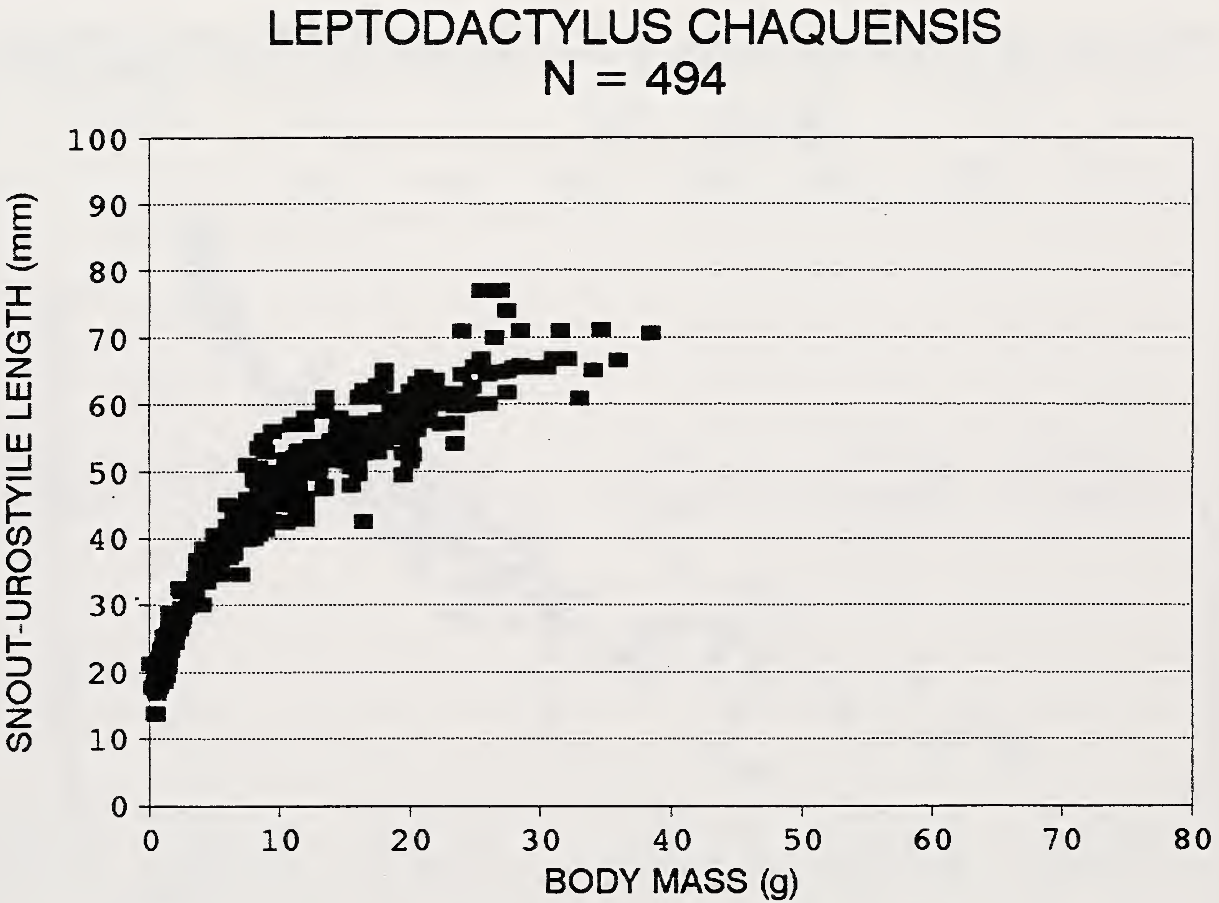

Fig. 2. Snout-urostyle length vs body mass relationships of 494 specimens of *Leptodactylus chaquensis* from El Bagual Ecological Reserve, Argentina.

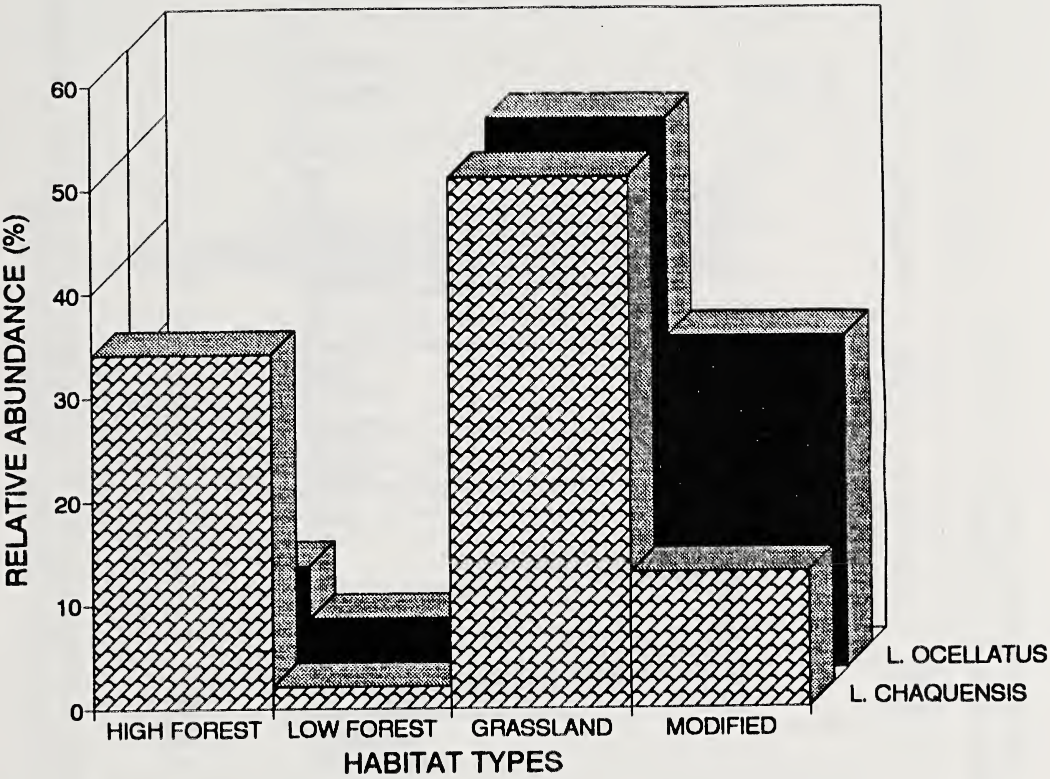

Fig. 3. Per cent of individuals of *Leptodactylus ocellatus* and *L. chaquensis* captured in four habitat types at El Bagual Ecological Reserve, Argentina.

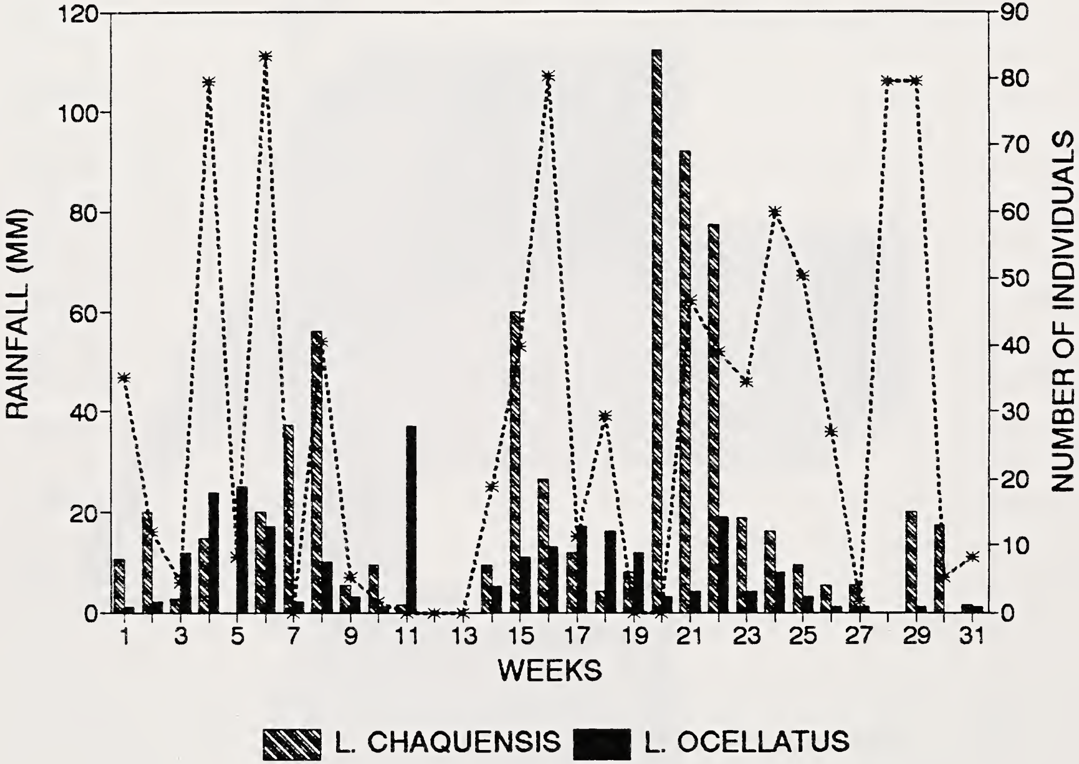

Fig. 4. Rainfall recorded and numbers of individuals of *Leptodactylus ocellatus* and *L. chaquensis* captured from 18 October 1993 to 18 May 1994, at El Bagual Ecological Reserve, Argentina.

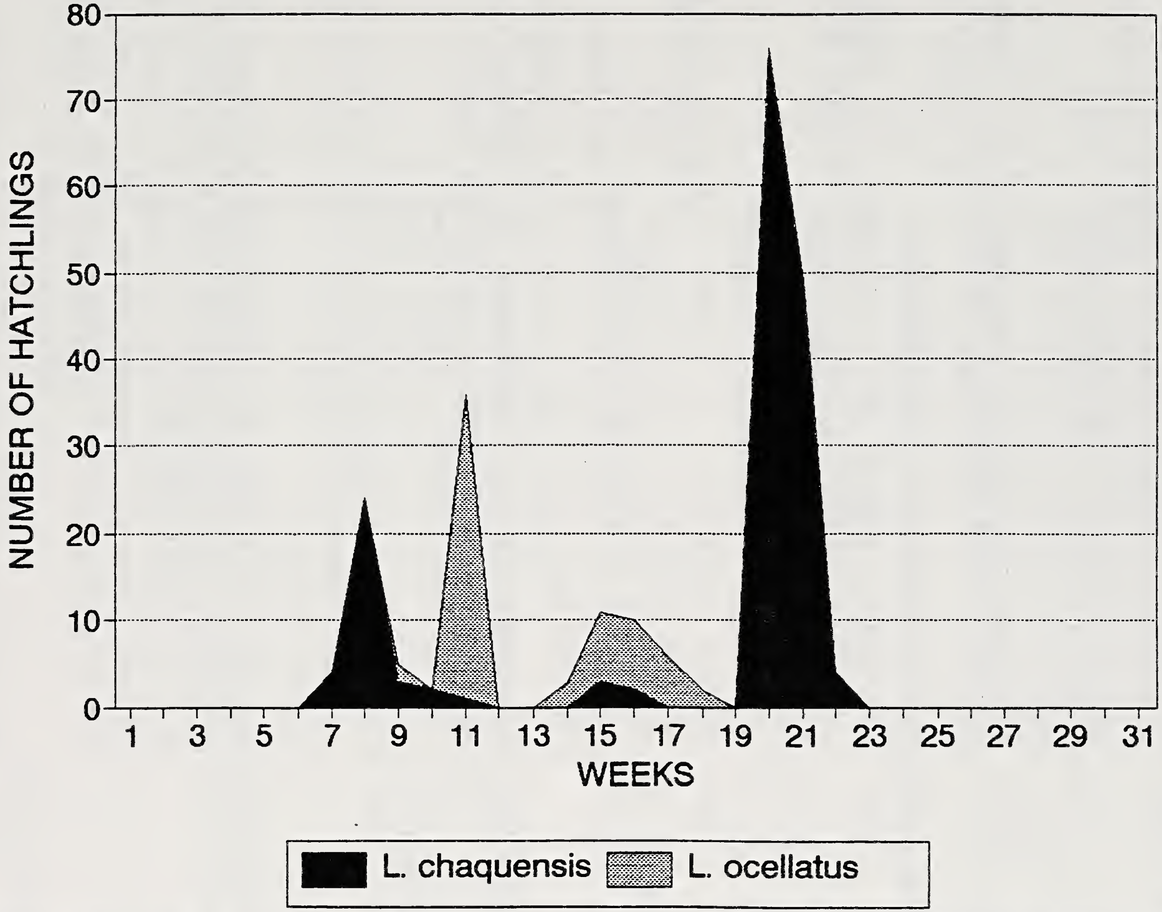

Fig. 5. Weekly (Temporal) appearance of hatchlings of *Leptodactylus ocellatus* and *L. chaquensis* from 18 October 1993 to 18 May 1994, at El Bagual Ecological Reserve, Argentina.

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MICROHABITAT IN ECOLOGICALLY DEVASTATED AREAS

Much has been written concerning ecologic devastation and the effect on animal life, yet there seems to be a note of hope for some species, even in the most destructive of environments. Haiti is representative of near ecologic disaster, the countryside, streets, cities being often radically ravaged so as to be a veritable faunistic desert. Yet enclosed courtyards (20 x 20 ft.) and dwellings in many towns, and orchards and yards in the countryside, offer microhabitat, food, and moisture availability for a considerable number of biota.

A study of courtyard herpetofauna throughout western Haiti reveals that several species of amphibians and reptiles not only survive, but thrive in such habitats. A list of summary notes indicates the extent of such adaptation.

Peltophryne guntheri: On two occasions, *Peltophryne* were encountered in outdoor restaurant gardens.

Bufo marinus: This commonly introduced toad is surprisingly scarce in Haiti. None was ever seen on streets at night in Les Cayes. One was found in an orchard north of Camp Perrin, and only two DOR individuals were recorded between Les Cayes and Laurent during many hours of bicycling in that area.

Eleutherodactylus pictissimus: A frog quite common in Cayes, *E. pictissimus* was most often found in enclosed courtyards, where refuge is sought beneath almost any covering. Several were taken in a single morning at one locality.

Osteopilus dominicensis: *Osteopilus* is to western Haiti the resident frog. It thrives in situations avoided by many anurans. For instance, these treefrogs were calling and breeding in an open cistern in an outdoor restaurant in Les Cayes.

They are one of the early residents in dwellings, living in thatch and on protected sills. Tadpoles have been collected in a small trickle by dwellings in mid-town, apparently able to adapt and mature within a considerable variety of situations.

Aristelliger cochranae: Sometimes, as with *Thecadadactylus,* these geckoes are the first to inhabit an orchard or occasionally dwellings. They are often found in large shade trees.

Hemidàctylus brooki: As commonly with *Hemidactylus, H. brooki* is a household lizard in the Port-au-Prince area, living in kitchens, porches and gardens.

Sphaerodactylus copei: The most abundant gecko in courtyards in western Haiti, stable populations occur at several localities studied.

These geckoes and the next two species are active day and night.

Sphaerodactylus cinereus: This seems to be the most scarcely represented of the three small geckoes, few numbers being found anywhere. They apparently prefer walls and structure to plants.

Gonatodes albogularis: As with the former two species, *Gonatodes* occurs where retreat is available in suitable habitat around dwellings.

Anolis cybotes: The large-headed anole is common in courtyards, gardens and orchards throughout western Haiti.

Anolis distichus: Although quite common in towns, these lizards usually inhabit palm groves in such areas. However, in the hills above Camp Perrin, they become more common in orchards and other man-made habitat.

Anolis coelestinus: This species is present in widespread and varied situations in lowlands, Massif de la Hotte, and on islands such as Ile á Vache.

As with the former two anoles, it occupies the variety of man-made habitats and is quite tolerant of human presence. One lived in a lone papaya on the third floor patio for three months.

Another interesting habitat is vine-covered outdoor restaurants, where it is quite common, as with *A. distichus*.

Leiocephalus personatus: A locally (habitat-specific) common lizard, populations thrive in some humanly-protected yards of small farm areas in Massif de la Hotte. This apparent concentration is probably a reflection of decimation in disturbed surrounding habitat.

Ameiva taeniura: Some populations survive in Cayes, especially near yards and yard edge beside a fresh-water trickle which flows directly into Baie de Cayes a few feet away. Occurring in yards and open parts of orchards, they have not been observed in courtyards.

Uromacer catasbeyi: Although I do not think this snake is an inhabitant of courtyards and orchards *per-se*, they are known to occasion them, probably in search of food.

Thus, even amidst quite heavily disturbed habitat, certain of the herpetofauna do quite well in the special circumstances provided by microhabitats.

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IMPORTANT HERPETOLOGICAL NOTES FOR NORTHERN ILLINOIS AND SOUTHERN WISCONSIN

Although areas might be surveyed for years, and reports submitted, it usually happens that certain species populations are not discovered even though expected to occur. In the cases of *Terrapene ornata* and *Pituophis melanoleucus* in Winnebago Co., Illinois, their presence - not established at the time of either my earlier report (Copeia, 1956) or Smith's work (Amph. & Reptiles of Illinois, Bull Ill. Nat. Hist. Survey, 1961) - is important both ecologcially and herpetologically.

A population of *Terrapene ornata* does exist along the Sugar River sand plains at least from Yale Bridge in north-western Winnebago County, Ill. northward into Rock County Wisconsin. Much of the area (especially in southern Rock Co.) is extensively low spring-fed and marshy, supporting populations of such species as *Emydoidea blandingi, Nerodia sipedon, Chelydra* and *Chrysemys.*

Pituophis is scarce in north-central Illinois, but specimens have been examined near Pecatonica, Winnebago Co. As a note of completion of species new there, *Storeria occipitomaculata* can be added to the list, occurring as it does near Yale Bridge.

Because of the desire to conserve populations, and inasmuch as these species are well known from surrounding areas, voucher specimens were not taken; in fact, they seem unnecessary in this case.

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A CASE OF PRODICHOTOMY IN A WILD-CAUGHT *ELAPHE OBSOLETA OBSOLETA*

A specimen of Black Rat Snake (*Elaphe obsoleta obsoleta*) held in the Ohio University Vertebrate Collection was found to be prodichotomous. The specimen, (OUVC 3875), was collected near Racine, Meigs County, Ohio by Ingels in October, 1958. No data on the cause of death are available. However, the middle of the specimen appears to have been artificially flattened. It is possible that this was a road-killed specimen, although there is no skeletal damage. Judging by the dark patch on the ventral surface at the level of the liver the animal was probably found dead, or at least was not fixed immediately upon death. The specimen is 223.78 mm SVL for the left head and 226 mm SVL for the right head. Bifurcation occurs at 34.96 mm from the snout of the right head. At least 36 vertebrae posterior to the atlas are duplicated (Fig. 1). The specimen was diagnosed prodichotomous following the description given by Smith and Pérez-Higareda (1987). Tuck and Hardy (1970) do not list *E. o. obsoleta* in their listing of species known to exhibit "cranio-and anteriodichotomy" prior to 1970. Burghardt, et al (1982) described the feeding behavior of a bicephalic member of this species. The present specimen (OUVC 3875) could be the first known case of prodichotomy for *E. o. obsoleta*.

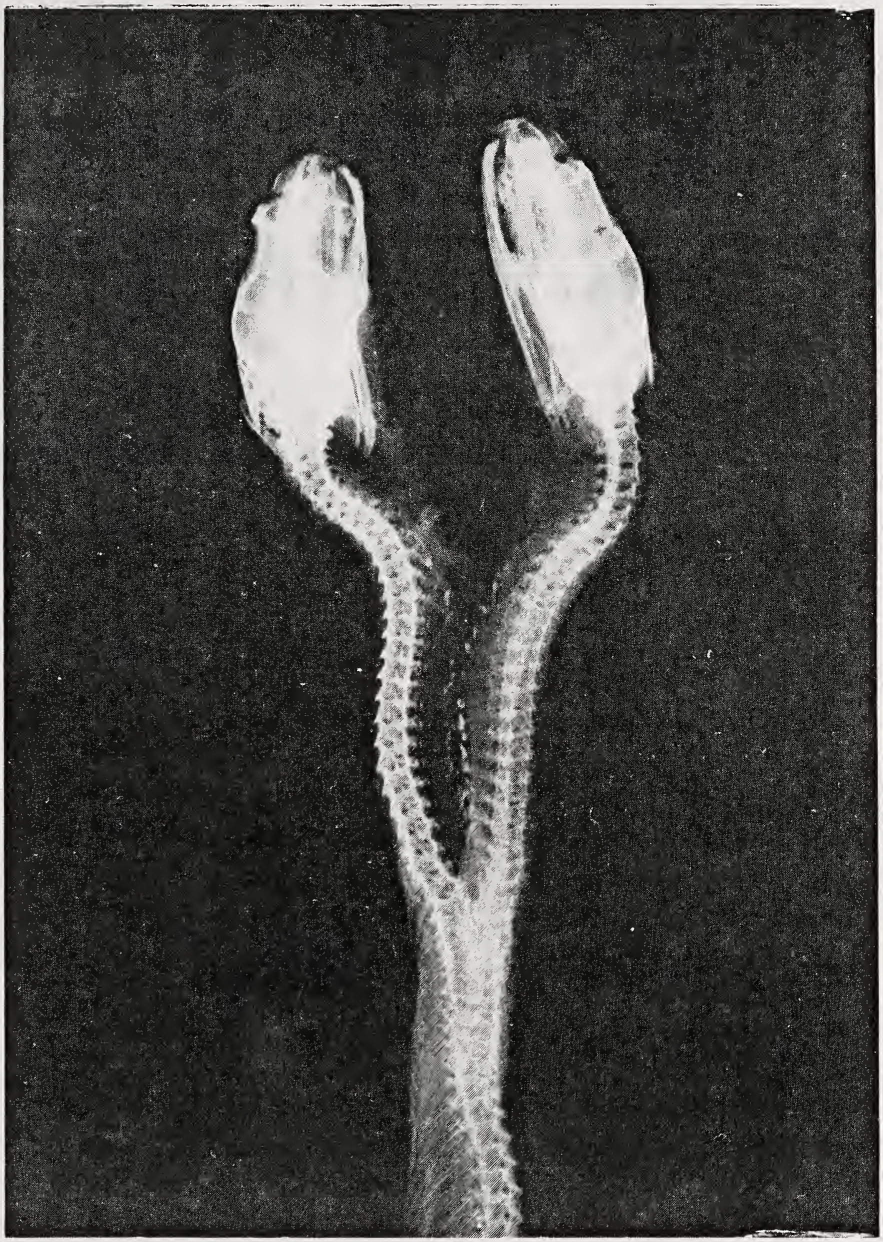

Fig. 1. X-ray of prodichotomous Black Rat Snake (*E. o. obsoleta*) held in Ohio University Vertebrate collection (OUVC 3875).

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UNUSUAL *NERODIA SIPEDON* FOUND AT JUG BAY WETLANDS SANCTUARY

An unusually patterned Northern water snake, *Nerodia sipedon*, was collected at Jug Bay Wetlands Sanctuary, southern Anne Arundel County, Maryland, in June 1994. The specimen was found during a Sanctuary-wide census of herpetofauna while sunning itself at the edge of the freshwater tidal marsh. A second very similar snake was also sighted.

The snake's coloration was atypical of *N. sipedon* seen at Jug Bay. Its dorsum was uniformly tannish brown, with no crossbands or pattern. Its cream white venter had no crescent markings. A bright yellow stripe ran down the underside continuously from the chin to the tip of the tail. Black speckling appeared 9 cm from the nose and bordered the yellow stripe. The stripe and speckling became less separate between the vent and the tip of the tail. Less than ten red dots were scattered on the ventral side. There were small black blotches on the sides 17 cm from nose and continued to the tip of the tail. The snake's nose to vent length was 54 cm; vent to tip of tail was 18 cm. Weight was 118.8 g.

The behavior of this snake was also unusual for the species, *N. sipedon* are known to be vicious - biting and thrashing when handled. This snake remained calm and was relatively pleasant to handle. Never, in the three months of captivity, did it attempt to bite. Several sheds were collected from the snake prior to its release.

Pattern variations are not uncommon in *N. sipedon*. Dorsal patterns are often prominent in juveniles but often are obscured in older or larger adults. McCauley (1945) observed three variations in specimens collected in Maryland at that time. He noted that individuals from Charles County tended to have "the dorsal pattern more or less obliterated. In some specimens it is entirely absent, the color above being uniform brown or gray" and "the ventral markings of these specimens are also much reduced. The belly is light cream or yellowish, with lateral black dots".

Initial identification attempts of this specimen suggested a possible aberrant *N. erythrogaster*, a species found only in Dorchester and Wicomico Counties with one questionable sighting in Anne Arundel

County (Harris, 1875). However, Conant (1943) showed that *N. erythrogaster* from the northeast all had larger eyes than *N. sipedon.* In *N. erythrogaster* the diameter of the eye is larger than the distance from the nostril and the eye orbit, while in *N. sipedon* the diameter of the eye is smaller than the distance between the nostril and orbit. In the Jug Bay specimen, the eye was clearly smaller, characteristic of local *N. sipedon.* Measured from a shed skin, the diameter of the eye was 3 mm while the distance from the nostril to the orbit was nearly 5 mm.

I would like to thank the Anne Arundel County Department of Recreation and Parks for supporting my research.

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News and Notes:

Reptiles in Hartford County Maryland: Distribution and Behavior of Reptiles at Camp Moshava

This survey details the reptiles observed at the old fresh air camp, currently Camp Moshava, a few miles south of Rocks State Park, off Cherry Hill Rd. Records are from the summer of 1994, however observations over the last eight years will be considered in the discussion. The data was collected from 16 June through 13 August 1994, when the author was the nature counselor at Camp Moshava.

The camp had three large mulch piles delivered in the fall of 1993. These mulch piles were beneficial in three major ways: they provided suitable hibernation sites, offered favorable nesting sites, and provided sufficient moisture to facilitate shedding. Snakes were seen to be active about the mulch piles throughout the summer months.

Prey, in the form of small rodents, was observed to be in particular abundance. Upon arrival to the camp site in the middle of June most of the buildings were seen to have heavy mouse infestation. Mice were frequently seen throughout the summer in sheds and infrequently used buildings. The many tool sheds and storage sheds were also home to many small birds whose nests were often seen above rafters or in fan vents. Other animals including young rabbits, squirrels, and chipmunks were undoubtedly taken as prey, although the author noticed no significant increase in their populations.

Data/observations:

Throughout the summer much of the data was gathered during "snake searches" consisting of 10 campers (age 9 to 15). These searches usually lasted two hours and were conducted daily. The author was also alerted to the presence of many snakes by campers who had observed them throughout the camp. A few hours were also spent in the late morning and early afternoon by the author alone. Larger groups of campers 20-30 were also led on nature hikes three days a week. The aformentioned activities usually resulted in between three to five hours a day spent in the field.

Discussion:

The most frequently occurring reptile throughout the camp grounds is undoubtedly *Elaphe obsoleta*. This snake was most often encountered basking in the morning on paths or clearings. However it was also frequently found hunting or hiding in the camp's many sheds and storage rooms. Five sloughed skins were found in four different sheds. Numerous individuals were observed crawling through dense thicket at the edge of the woods, their location often revealed by the rustle of dry leaves. Individuals were usually encountered in the morning, however beginning in July they were also found hunting at dusk and at night. The snakes were more frequently seen on days after a rain or after cool days.

One four foot specimen was found coiled on top of a mouse nest in an abandoned room of a large shed. Many specimens brought to my attention were sighted foraging behind or next to the camp's many bunks, all of which showed some signs of rodent populations. One six footer was caught in the act of swallowing a freshly dispatched young rabbit. Another large specimen was observed in a thicket with a large bulge, probably due to a recently consumed small rabbit or squirrel.

When encountered the black rat snake's first reaction is usually to bolt towards the thicket or tall grass, in some instances a nearby hole or rodent burrow served as an emergency retreat. Small trees and bushes were also used as escapes, where the black rat exhibited its expert climbing ability. When cornered the snake assumes a defensive posture, raising its head and a coil a few inches off the ground. The snake never attempts to strike, but rather prefers to flee after a few moments of intimidating glare. When picked up the snake invariably turns and delivers a quick, but not very painful, bite and continues to attempt escape, but will rarely bite again. In two instances the author's hands were unsuspectingly covered with a thick, foul-smelling musk.

The camp's mulch piles provided favorable nesting sites for *Elaphe obsoleta*. Two clutches of 8 and 10 eggs were uncovered when one of the mulch piles was moved and the eggs were transplanted to another pile. A massive clutch of 25-30 eggs was found under a large rock in a grassy meadow. The rock was next to a small stream which provided ample moisture for the incubating eggs.

The next most frequently encountered snake was *Diadophis punctatus*. This secretive little snake was usually found under large rocks in the moist forest soil. However one specimen was found under a rock in rather dry soil at the edge of the forest, sharing its home with a large toad. Although this snake was never observed above ground, a freshly cast skin was found on an overturned tree stump a few feet above the forest floor. When handled, this snake did not attempt to bite, however on two occasions the authors hands were smeared with small amounts of musk.

Thamnophis sirtalis was only seen on two occasions. One individual was uncovered under a large rock near the lake. The snake however, made a quick get-away into high grass along side the lake. There are undoubtedly many more living around the lake as frogs are present in high numbers. A baby garter snake was seen under the cover of a small bush in the afternoon in early August.

Two eastern milk snakes, *Lampropeltis triangulum*, were found on a rocky hill bordering the lake. They were both uncovered under large rocks about 5 yards apart from each other. When one of the snakes was seized it immediately sent its lower two thirds of its body into a network of small tunnels. The author had to remove 6" of soil to secure the snake. Both of the individuals were juveniles with the first being about 12", second was slightly larger about 14-16".

Although not observed by the author, a copperhead (*Agkistrodon contortrix*), was seen along the wall of the upper girls bathrooms in the summer of 1993. Surprisingly the snake was found by some campers during the day (although the exact time is not known). Unfortunately the snake was dispatched with a rake by one of the counselors. A photograph was taken which allowed identification of the snake. From descriptions by witnesses and the photograph, the snake was estimated to be approximately 18" long. The bathrooms and the adjoining swimming pool attract numerous frogs and toads. These undoubtedly provided ample prey for the copperhead.

Two species of turtles were observed on the camp's property. The painted turtle, *Chrysemys picta*, was observed in the camp's man-made lake. *Chrysemys picata*, was often observed as it surfaced near the lake's dock, or swimming slowly in shallow water near the lakes edge. Although not seen by the author, it is assumed that the turtle probably basks among fallen logs at the inaccessible far end of the lake.

The eastern box turtle, *Terrapene carolina*, also makes its home throughout the camp grounds. This small turtle was often seen foraging beside paths under wild raspberry thickets. The author alerted to its presence by the rustling of leaves. It was most often sighted in the morning, usually after heavy rains. One box turtle was observed in the unlikely habitat of an old barn, as it was seen peering out through a large hole in the wall. Upon being picked up, the turtle reacted with a loud hiss followed by quick withdrawal into its shell.

Two *Eumeces fasciatus* were found in a camp buildings. The first, a 6" specimen, was found on the inside of a window screen in the camp's library. This skink was observed throughout the summer foraging about the library's window sills and basking on the window screens. Moths probably comprised the major prey as they were attracted to the library in large numbers. A second, larger specimen was found under a box in a storage room in the back of the kitchen. This unfortunate specimen was found dead, although perfectly preserved.

This property has remained largely unmolested over the years. As the property is owned by Camp Moshava, and no large scale developmental plans exist, this area will continue to be a hidden oasis for Maryland's reptile populations.

– *Philip Martin,* 12813 Huntsman Way, Potomac, MD 20854.

Received: 14 December 1994
Accepted: 30 December 1994

News and Notes:

Book Review

Catalogue of Valid Species and Synonyms. Vol. 1: Crotalidae. 1993. Published by Herprint International cc, P.O. Box 14 241, Bredell 1623, Republic of South Africa. Price US $45.00

This publication on the family Crotalidae (often considered a subfamily of Viperidae) is the first check-list in a series which is intended to cover all taxonomic groups of reptiles and amphibians in the future. Today we already have many types of check-lists, so why should this new series be necessary? To my knowledge, the existing check-lists all suffer from becoming outdated rather quickly, virtually they are often outdated at the time when they are published. But that should not apply to this new system. Each volume is a loose-leaf system (four-hole punched) where the individual pages can be replaced as changes appear. When you buy a volume from the publisher, you will automatically receive the next batch of exchange pages, on account (US $0.50 per page). As long as you pay for them, you will receive future exchange pages, and your check-list will be kept up-to-date. In that way I think this new system serves a good purpose.

The price is modest compared to that of other check-lists like "Das Tierreich". However, considering that this publication is a ring binder with loose-leaf pages, one can not say that the price is low.

For each species and genus a list of literature (not only taxonomic) is given in a chronological order. Obviously, for this list many additions must be made, however, the publisher is aware of that and invites the readers to give their contributions. But I think the publisher should make a basic requirement to authors when (at least) original pages are made: Specific standard publications or indexes which provide the most important references *must* be consulted. Examples: Zoological Record (always), Wolfgang Böhme's "Handbuch der Reptilien und Amphibien Europas" (for European species) and SSAR's "Catalogue of American Amphibians and Reptiles" (for New World species).

I think it is a good idea that not only taxonomic literature is mentioned. But for the just reasonably well-known species the chronological list of literature will be (or become) huge and very hard to overview - typically if you want to search for a specific subject like physiology, embryology or taxonomy for one or more species. Here I recommend the publisher to group the literature according to subject. One way of doing it would be to mark each reference with codes for various subjects. One reference may well cover more subjects. Zoological Record and Wildlife Review (published by the U.S. Fish and Wildlife Services) may provide inspiration for establishing these subject groups.

So far the geographical distribution for the taxa has been excluded, but the publisher indicates that such paragraphs can be added later. I fully support this to be done at species, genus and family level.

A difficult issue is about authorship, i.e., the person(s) responsible for a species account. Currently, only the person having made the latest contribution to a species account is mentioned (either for an original page or a corrected page). I believe that all persons who have contributed to an account should be mentioned. I realize that it can be hard to see who has contributed what (e.g., one person has made the basic work, another one has just added a few references). On the other hand, the idea behind this system is entirely to provide check-lists and lists of literature, not to express opinions as is stated in the introduction.

But for each volume one or more named persons will inevitably have to be mentioned as overall responsible for the taxonomy and nomenclature applied, I suggest. This principle must also be adhered to as corrections/additions are made. At present not even the editor is mentioned.

The intention of not expressing opinions leads me to another point, a paragraph for "comments" which has for that reason so far been omitted. Nevertheless, for many (most?) taxonomic groups there are diverging opinions on taxonomic arrangements which will necessitate that one at least decides which one to choose. In order to explain that choice, an appropriate addition to the catalogue will be such a paragraph "comments" as in "Amphibian Species of the World" (by Darrel Frost [1985] and corrections and additions by William E. Duellman [1993]). That seems to be the only acceptable solution, irrespective of the basic philosophy behind this series.

I am not a specialist in systematics of crotalids and shall refrain from making a detailed review of the taxonomy adopted by the contributors. However, I must add one basic remark on the accounts on the genus *Tropidolaemus* and the species *Tropidolaemus wagleri*, contributed by G. Vogel. Nowhere in the literature lists you can see how come *Tropidolaemus* has been accepted as a valid genus and *wagleri* belonging to that genus. That should not have been accepted by the publisher. Also here a paragraph "comments" would be appropriate.

Trimeresursus wiroti is listed as a junior synonym of *T. puniceus*, but the reference responsible for this action (Nutphand et al., 1991) has been omitted.

The rather new publisher "Herprint", run by the two Germans Thomas and Elké Ulber, have taken a fine initiative by starting this herpetological series, Catalogue of Valid Species and Synonyms. Some basic improvements to Ulber's system will be necessary, and I find it positive that proposals are welcomed in the introduction to this initial volume. Additionally, to become a strong and important check-list system it will need the competent experts within the individual taxonomic groups to participate in this project. With the above reservations, I can recommend the catalogue to herpetologists dealing with the various families like Crotalidae as well as to institutions involved in herpetological literature.

Literature Cited

Nutphand, Wirot, Merel J. Cox, Ludwig Trutnau and Hobart M. Smith. 1991. The status of the Thai palm viper, *Trimeresurus wiroti*. Bull. Maryland Herp. Soc., 27(3): 146-165.

– *Henrik Bringsøe*, Esthersvej 7, DK-4600 Køge, Denmark.

Received: 28 July 1994

News and Notes:

Book Review

The Amphibians and Reptiles of Alberta, by Anthony P. Russell & Aaron M. Bauer, 1993. University of Calgary & Univ. of Alberta Press, v-x +264pp. $25.50

In this moderately priced, and long awaited volume Russell and Bauer have achieved their aim to "provide a specific reference about amphibians and reptiles in general, placing the herpetofauna of Alberta into a broader global content."

The introduction gives a brief, yet well written glimpse of environmental factors affecting the amphibian and reptile fauna of Alberta, as many species are at the periphery of their northern range. This is followed by a generalized outline on the characterization of amphibians and reptiles.

Chapter three is an introduction to the amphibians and reptiles found in Alberta, along with a breakdown of the number of species occurring in all the Canadian provinces and territories. This is well illustrated in a table that also provides major reference sources for each area.

The fourth chapter provides ideas on how to observe herptiles, which will be of interest to the layperson, which is followed by well illustrated keys to the adult amphibians and reptiles, and also keys for larval amphibians and eggs of the different species found within Alberta.

Three full pages are devoted to the account of each native species. Two pages are devoted to the common and scientific names, identifying characters, variation, reproduction, distribution, natural history, status and similar species. The second page of each account carries a large full page map of the province, which provides distributional dots, which we have no indication of what type of records these localities are based on. Knowing the authors I would assume these are based on museum specimens and not sight and literature records. Each species account is followed by a listing of significant references, as are all chapters.

Following the species account is a most interesting review of the zoogeography of Alberta herpetofauna. The province is divided into four biomes which are primarily associated with elevation profiles and drainage basins. These biomes are well illustrated with maps and figures. This is followed by a short chapter on natural history, coping with the cold, challenge of aridity and defense and venoms.

Of the eighteen species known to occur in Alberta, two are salamanders, nine frogs and toads, two turtles, one lizard and eight snakes. Four additional species, *Ascaphus truei, Chelydra serpentina, Charina bottae* and *Coluber constrictor* are also given full descriptions within the text, although they have not been collected or observed, although they should occur within the province.

Alberta is noted for having a harsh climate which places limitations on the number of species occurring in the province. The authors feel that agricultural practices, industrialization and urbanization along with "global warming" and "acid rain" are drastically threatening both amphibian and reptile populations within Alberta, as well as throughout the world. Emphysis on population declines has been stressed, with hopes of making the public more aware of the fact that direct human intervention and other influences are drastically threatening our worldly creatures.

The attractive color figures of the eighteen know herptiles found in Alberta were provided by Wayne Lynch, while other illustrations are by Irene McKinnon.

Over 980 specific references are cited in the bibliography, of which no less than 100 are directly related to the herpetology of Alberta. The authors should be commended for their excellence in providing such an outstanding contribution the Canadian field of herpetology.

– *Harlan D. Walley,* Department of Biology, Northern Illinois University, DeKalb, Illinois 60115.

Received: 17 September 1994

News Books:

Turtles of the United States and Canada

by Carl H. Ernst, Jeffrey E. Lovich and Roger W. Barbour

IBSN 1-56098-346-9 Price: $60.00*

Ordering information:

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THE MARYLAND HERPETOLOGICAL SOCIETY SURVEY

It's been almost twenty years since the Maryland Herpetological Society published the last edition of the Distributional Survey (Amphia/Reptilia): Maryland and the District of Columbia by Herbert S. Harris, Jr. In that time four species have been added to the state's fauna, concepts of the local distribution of many species have changed, and concern has been expressed over the apparent reduction in numbers of various species. The MdHS is initiating a five year survey of Maryland's herpetofauna leading to preparation of a comprehensive publication (or publications) dealing with local herpetology. This survey will have several facets, as described below.

Distributional Data

Species distributions will be depicted with computer generated maps based on the U. S Geological Survey quad system. This will provide a reasonable degree of accuracy, easy update, and reliable documentation. Although the database will be maintained at a central location, county coordinators will be assigned to receive and review data for their area. When this project gets rolling, we anticipate that draft maps will be circulated on a regular basis to identify gaps where special attention should be directed. These maps can be coded to show historic vrs. current records.

As has been traditional with herpetological survey efforts, we welcome data associated with well preserved specimens deposited in a permanent collection. However, consistent with today's emphasis on observation as opposed to collection, we also consider sight records from reliable observers to be acceptable. Unusual occurrences or records for species that may be confused (i.e., "coastal plain milk snakes" and scarlet snakes, or new records for rainbow snakes) should be document photographically, and we encourage maximum use of cameras. The MdHS is establishing an archive for permanent storage of such slides and photographs.

Natural History

The North American literature contains a wealth of information about the natural history of the amphibians and reptiles that occur in Maryland. However, most of that information came from other areas and relatively little is specific to this state. For instance, can anyone precisely define the period during which gray treefrogs or narrowmouth toads call in Maryland? Conant and Collins, because they consider the entire range, give a period that s much too broad. Management of our local amphibian and reptile species requires that we know much more about their life histories than we do. Consequently, we are taking this opportunity to gather every bit of biological information that we can get on every resident species. Participants are encouraged to record and report all biological observations, even those that seem ordinary. A standardized record form will be provided for this purpose. The following list gives examples of the kinds of questions that we hope to answer.

> Have you observed changes in local distribution? Do you see species now that you did not see the past, or vise versa?
>
> When exactly do various species of frogs start and stop calling?
>
> What do our herps eat, and what eats them? What kind of aggressive encounters occur?
>
> When do they mate? When and where do they lay eggs, and how many? Do you note evidence of nest predation, and do you know what did it?
>
> What kind of parasites occur on/in wild caught herps?
>
> Where do our amphibians and reptiles hibernate (have you ever dug out a snake or frog in winter), and when do the enter and leave hibernating areas?

Long-term Population Monitoring

We also propose to coordinate a series of long-term studies at selected localities (one in each county would be ideal) to monitor numbers of reptiles and amphibians at specific locations. These surveys will be modeled after the one now being conducted at the Jug Bay Wetlands Sanctuary in Anne Arundel Count, and should detect and

document any changes that may be occurring in local populations. The role of the MdHS in this effort will be to help establish programs to provide even coverage, to ensure that comparable data is being collected in a standardized fashion, and to collect and evaluate data to formulate a state-wide picture. We can also serve as a clearinghouse for the dissemination of the data obtained to participants and other interested persons.

Another aspect of this survey will be an effort to gather personal observations of changes in abundance and distribution. We constantly hear naturalists lament that spotted salamanders no longer spawn in the pond in their woods or that a favorite copperhead den has been destroyed. Such information has been given little credibility because it is anecdotal, and no effort has been made to verify and quantify it so that it can be considered when management of amphibian or reptile populations is considered. We feel that such information is useful and will make every effort to compile it.

Accessibility of Data

Although our ultimate goal is publication of the data gathered, this will be an interactive association with relatively free access to information. We hope to find funding to computerize early-on. If so, we can generate regular hardcopy updates or open the files through the phone lines. However, security will be placed on sensitive information. The last thing that we want to do is apply additional stress to local populations. On the other hand, so little good information is available that we will strive to get information flowing as soon as we can.

How to Participate

At the present time we plan to begin developing the data base in January 1995. In the interim a "steering committee" has been established to deal with such questions as exactly how data is to be collected and in what form, how it will be packaged, how and where it will be stored, what the data sheets will look like, how access to data will be provided, and what the final products will be. A lot of work remains to be done and we would like to hear form you if you have comments, questions, suggestions, or a desire to assist. A mailing list is being developed and information should start appearing late this summer.

If you are interested in participating in this project please fill out the following form and return it to: **Maryland Herpetological Society Survey, Natural History Society of Maryland, 2643 North Charles Street, Baltimore, Maryland 21218.**

Name____

Address____

____

Phone____

Interest: County Coordinator________

(if so, which county ______________________

Suggestions:

Notes:

MID-ATLANTIC REPTILE SHOW 1995

Sponsored by the Maryland Herpetological Society

September 16th & 17th 1995

Saturday 10:00am to 4:30pm (Lectures 7:00pm to 11:00pm)
Sunday 11:00am to 6:00pm (Speakers to be announced)

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Dr. David Chiszar (Univ. of CO)
Philippe de Vosjoli (Author)
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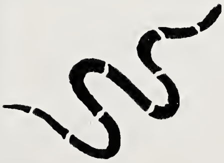

The Maryland Herpetological Society
2643 North Charles Street
Baltimore, MD 21218-4590
contact Tim Hoen, show coordinator, at (410) 557-6879

The Maryland Herpetological Society is a non-profit 501(c)3 organization.

Notes:

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Society Publication

Back issues of the Bulletin of the Maryland Herpetological Society, where available, may be obtained by writing the Executive Editor. A list of available issues will be sent upon request. Individual numbers in stock are $2.00 each, unless otherwise noted.

The Society also publishes a Newsletter on a somewhat irregular basis. These are distributed to the membership free of charge. Also published are Maryland Herpetofauna Leaflets and these are available at $.25/page.

Information for Authors

All correspondence should be addressed to the Executive Editor. Manuscripts being submitted for publication should be typewritten (double spaced) on good quality 8 1/2 by 11 inch paper with adequate margins. Submit original and first carbon, retaining the second carbon. If entered on a word processor, also submit diskette and note word processor and operating system used. Indicate where illustrations or photographs are to appear in text. Cite all literature used at end in alphabetical order by author.

Major papers are those over 5 pages (double spaced, elite type) and must include an abstract. The authors name should be centered under the title, and the address is to follow the Literature Cited. Minor papers are those papers with fewer than 5 pages. Author's name is to be placed at end of paper (see recent issue). For additional information see *Style Manual for Biological Journals* (1964), American Institute of Biological Sciences, 3900 Wisconsin Avenue, N.W., Washington, D.C. 20016.

Reprints are available at $.03 a page and should be ordered when manuscripts are submitted or when proofs are returned. Minimum order is 100 reprints. Either edited manuscript or proof will be returned to author for approval or correction. The author will be responsible for all corrections to proof, and must return proof preferably within 7 days.

The Maryland Herpetological Society
Department of Herpetology
Natural History Society of Maryland, Inc.
2643 North Charles Street
Baltimore, Maryland 21218

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30 SEPTEMBER 1995 VOLUME 31 NUMBER 3

BULLETIN OF THE MARYLAND HERPETOLOGICAL SOCIETY

Volume 31 Number 3 September 1995

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mdhs

Volume 31 Number 3 September 1995

The Maryland Herpetological Soceity
Department of Herpetology, Natural History Society of Maryland, Inc.

Executive Editor Herbert S. Harris, Jr.

Steering Committee

Frank Groves Jerry D. Hardy, Jr.

Herbert S. Harris, Jr.

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Membership Rates

Membership in the Maryland Herpetological Society is $20.00 per year and includes the Bulletin of the Maryland Herpetological Society. Foreign is $30.00 per year. Make all checks payable to the Natural History Society of Maryland, Inc.

Meetings

The third Wednesday of each month, 8:15 p.m. at the Natural History Society of Maryland (except May—August, third Saturday of each month, 8:00 a.m.). The Department of Herpetology meets informally on all other Wednesday evenings at the NHSM at 8:00 p.m.

NATURAL HISTORY OF *ADENOMERA HYLAEDACTYLA* (ANURA:LEPTODACTYLINAE) IN THE EASTERN CHACO OF ARGENTINA.

C. Mercolli, A. Alberto Yanosky and James R. Dixon

Adenomera hylaedactyla is cited for the first time from Argentina based on eight preserved specimens and 84 captured individuals from a pit-fall trap and fence system set up in a ecological reserve in northeastern Argentina. A general description of the specimens is made and a snout-urostyle length versus body mass is given for the first time for the species. The mark-recapture sample was composed of 70% juveniles and only one individual was recaptured, thus prohibiting population estimates. This species is primarily a nocturnal, terrestrial, leaf litter inhabitant of humid high forest. Its activity cycle appears to be synchronized with post-rain periods when soil humidity is high. Juvenile recruitment appears to be restricted to mid-summer with adult reproduction in late-spring/early-summer.

Introduction

A generic change to *Adenomera* was provided by Heyer (1973, 1974) for a group of leptodactylinae frogs. Heyer (1977) discussed the composite species of *A. marmorata*, and this species may enter eastern Argentina (Misiones) from Southeastern Brazil, though its presence is yet to be confirmed (Cei, 1987). Yanosky *et al.* (1993) listed a Leptodactylinae frog identified as *Adenomera* (= *Leptodactylus*) *marmorata* from northeastern Argentina. Further studies on this species suggest that the species is *Adenomera hylaedactyla*, though there is no guarantee that these Argentinean specimens of *Adenomera* are conspecific with the true *A. hylaedactyla* from Amazonian Peru (Heyer, *in lit.*). We here describe the specimens found at El Bagual Ecological Reserve, northeastern Argentina, and offer comments on its natural history. This is the first record of the species for Argentina and the first notes on its natural history as the southernmost population recorded.

Materials and Methods

The study area is in the eastern-humid Chaco district of the Chaco province (Cabrera & Willink, 1973). All *Adenomera* specimens treated here were collected at El Bagual Ecological Reserve (26° 59' 53" S, 58° 56' 39" W) in northeastern Argentina. The area is characterized by flooded savannas and forests, subject to cyclic fires and flooding (Neiff, 1986). The soils, originating from volcanic ash of northwestern Argentina, are planosoles, gley-humid and alluvial with poor drainage, and influenced by Bermejo River lowlands (Hellman, 1987). The El Bagual Ecological Reserve is a 3,462 hectare protected area characterized by an annual mean temperature of 22-24°C with a maximum average of 27°C and minimum of 17°C. Extreme recorded temperatures ranged from -2 to 45°C and there is a marked rainy season (November-April) with an annual rainfall of 1200 to 2000 mm.

Eight specimens preserved at REB Herpetological Collection were examined together with data from 84 specimens captured in a pit-fall trap fence system set up at El Bagual. Fences were used from 12 October 1993 through April and captures were arranged in weekly intervals (week 1 to 29) for analysis. Four fences were established in each of the three major habitat types: humid high forest, low forest and shrubby savannas. Each fence is composed of plastic coated fiber 15 m in length, buried 10 cm in the ground and 40 cm high. One metallic funnel trap was placed on each side of the fence at mid point, with a 5-gallon container buried flush with the ground at each end of the fence. Each captured specimen was marked by a toe-clip according to Waichman's (1992) method, and snout-urostyle length (± 0.1 mm) (SUL), sex/age and body mass (± 0.1 g) were recorded. Captured specimens were released at the point of capture.

Results and Discussion

Description

Material examined is preserved in the herpetological collection of El Bagual Reserve [REB 20640 (1992), 21367, 21431-2, 21454-5 (1993), 21550, 21627 (1994)], Collected by A. A. Yanosky and J. R. Dixon in humid high forest from El Bagual Ecological Reserve, Formosa, Argentina.

Adult body length 20-28 mm, body mass 0.1-0.4 g. Smallest body length recorded was 13.3 mm. Head stout with snout short, rounded as seen from above (Fig. 1A), truncate in lateral profile. Nostrils lateral, internarial distance longer than nostril-eye distance. Loreal region is slightly concave. Tongue oval, entire and free behind. Maxillary teeth present. Two heavy plaques of vomerine teeth behind the choanae and closer among them when compared with choanae. Eyes large, lateral and prominent. Tympanic membrane round and smaller than eye diameter. A small supratympanic ridge present. Fingers free and tips dilated, rate of fingers 2°, 1° = 4°, 3°, metacarpal and subarticular tubercles very strong and well-developed (Fig. 1B). Toes unwebbed and unfringed, tips more dilated than fingers, outer metatarsal tubercle well-developed (Fig. 1C). When hindleg is adpressed heel falls between tympanum and eye. When bent at right angles to the body, heels overlap. Skin smooth non-granular dorsally; venter smooth, except for granular areas in ventral thighs. Thoracic fold is not evident.

Measurements (in mm) for REB-21550 are snout-urostyle length 25.1, tibia 10.5, head 9.3, foot 12.6, femur 10.8, hand 5.7, internarial distance 3.3, snout-nostril distance 2.3, snout-eye distance 2.6, ocular diameter 2.9, interorbital distance 4.7, superior eyelid space 2.3, tympanic diameter 2.3.

Preserved specimens are brownish on the back, paler on the sides. An interscapular subrounded creamish or orangish spot is present that extends posteriorly in a creamish or orangish stripe. Laterally, a darker stripe composed of irregular blotches is edged dorsally by a creamish (orange in life) band beginning behind the eye and extending to the groin. Faint dark transverse spots on femurs and tibiae, not forming transverse bands.

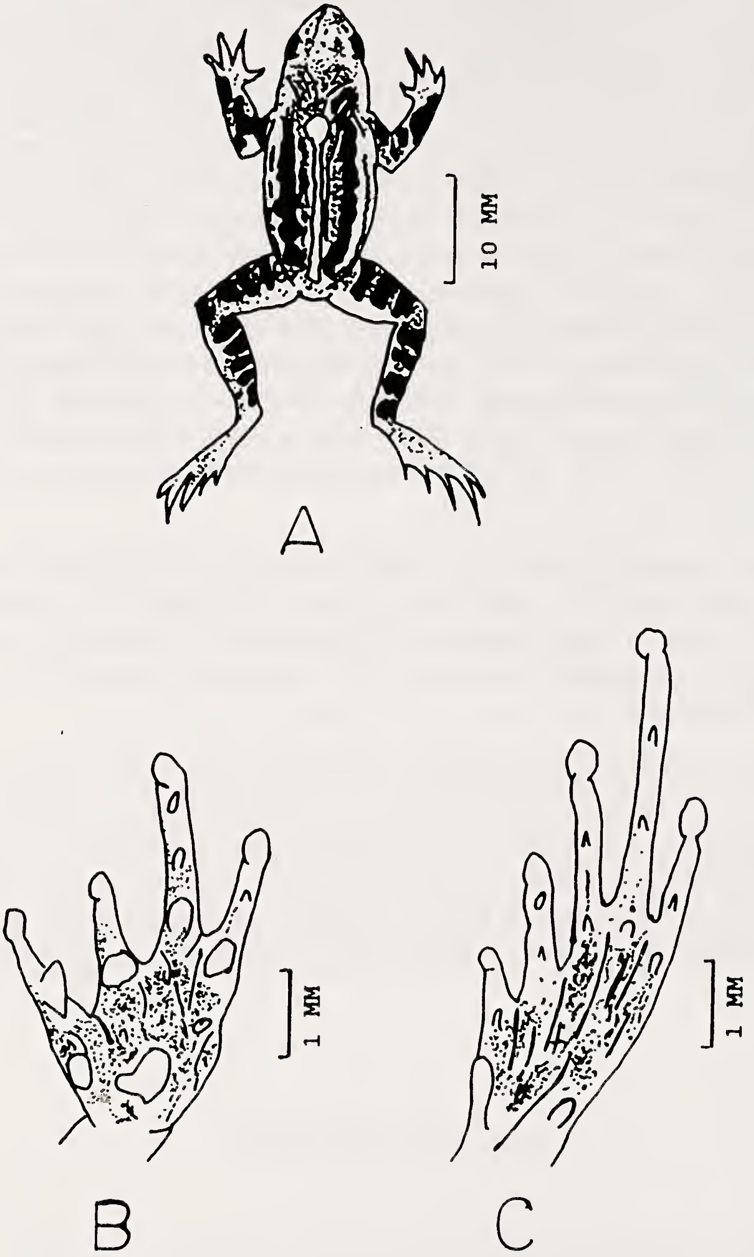

Fig. 1. *Adenomera hylaedactyla,* new for the Argentine territory. Dorsal view (A), hand (B) and foot (C).

Population Parameters

Eighty-four specimens of *Adenomera hylaedactyla* were captured, marked and released. Only one specimen was recaptured thus population estimates cannot be obtained. Juveniles composed almost 70% (n = 58) of the sample, followed by adult females 26% (n = 22) and adult males 4% (n = 4). 95% of the specimens fell in pitfall traps set in the fences and only 5% were taken from funnel traps. The smallest male measured 19 mm SUL, and the smallest juvenile measured 13.3 mm SUL.

A growth model is presented in figure 2. Correlation obtained from these data resulted in

$$\text{SUL (mm)} = 6.403 \text{ BODY MASS (g)} + 14.62$$

$$(n = 92, r = 0.88, r^2 = 0.775)$$

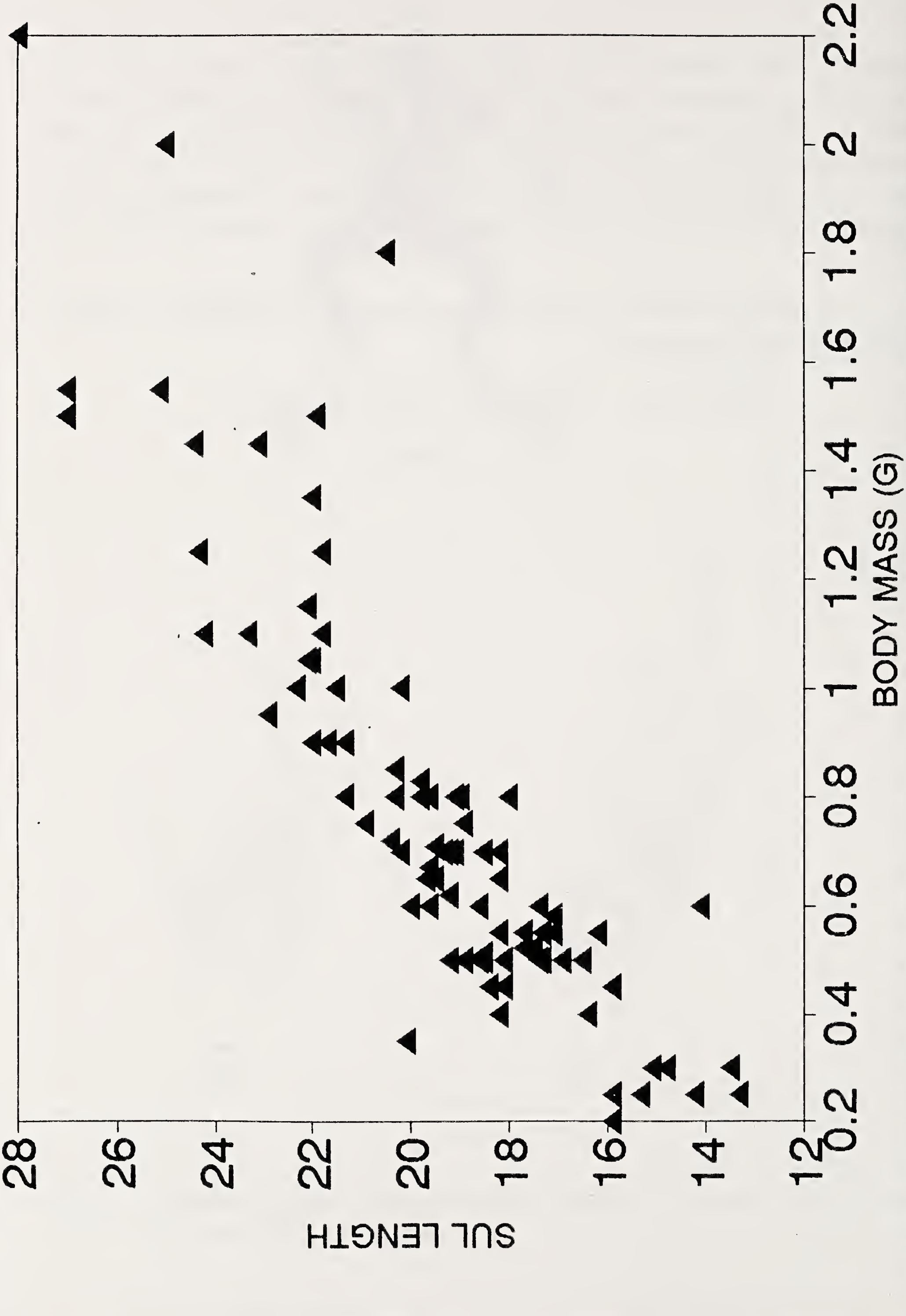

Fig. 2. Snout-urostile (body) length versus body mass for all-aged *Adenomera hylaedactyla* for a protected reserve in northeastern Argentina.

Biometric data for the species (n = 7) given by Rodriguez (1992) are SVL 23.05 mm and weight 3.15 g in preserved specimens. Our data for live animals suggest that a 23.05 mm SUL specimen would weigh about 1.31 g and not more than 3 g. The live weight of *Adenomera hylaedactyla* REB 20640, 28 mm SUL, was 2.2 g and after preservation 4 g.

Habitat Selection

Adenomera hylaedactyla was found principally in the humid high forest (84.5%, n = 71), followed in importance by shrubby savannas (9.5%, n = 8) and low forest (6%, n = 5). The humid high forest is an heterogenous climax woody formation with a broad specific density and complete canopy having five canopy layers, with the upper layer exceeding 20 m in height. The fifth stratum is composed of *Tabebuia ipe, Phyllostylon, Enterolobium* and *Ruprechtia*. The fourth stratum is dominated by *Diplokeleba, Chlorophora* and *Pisonia*. Within the third stratum there appear *Eugenia pungens, Chrysophyllum, Ficus monckii* and *Syagrus*. The shrubby second stratum is composed of *Trichilia, Linociera* and *Sebastiania*. The lower herbaceous stratum is dominated by the bromeliad *Pseudoananas macrodonthes*. Epiphytic plants such as *Rhipsalis* cacti and *Thillandsia* spp. occur in all strata.

Low forest is similar to the habitat type described above except for the maximum height of the top layer is 15-17, thus lacking the fifth stratum of the high forest. Shrubby savannas are extensive grasslands with few arboreal plants.

Adenomera hylaedactyla was found primarily in the high forest as a leaf litter dweller and commonly found under fallen logs during time-constrained searches. This is a terrestrial, nocturnal species and its presence in other habitat types is indicative of its adaptation for using available habitat types. In Amazonian Peru it is obviously adapted to high and humid forests. Rodriguez (1992) has characterized the habitat selected by this species as flood plains and forest in the Manu National Park, Amazonian Peru, We also agree with Rodriguez about its nocturnal activity and terrestrial habits.

All the specimens found in shrubby savannas and low forest were juveniles and the absence of adults in these habitat types may be due to colonization of the habitats by dispersing froglets following metamorphosis. In the humid high forest, all adult specimens were found together with froglets and juveniles. We did not observe reproduction, but we hypothesize that egg laying occurs in the humid high forest. Juveniles were found in grasslands and low forest, but no froglets were taken. Duellman (1989) and Hödl (1990) report that this species is a terrestrial foam nester, with non-feeding tadpoles that complete development in the nest. Preferred habitat for nesting are depressions in grasslands and other open formations with low vegetation according to Hödl (1990), but Rodriguez (1992) characterizes nesting in the same way within forest habitats.

Activity

From October through April, *Adenomera hylaedactyla* appear to be a common element in the high forest of El Bagual Reserve (Fig. 3), though the greatest activity was recorded for week 15 to 24 (late January through late March). Activity appears to be synchronized with rains, and especially after them, when soil humidity is high (Fig. 3). Moreira and Lima (1991) reported that *Adenomera andreae* showed continuous reproduction from September through April synchronized with seasonal rains in Amazonian Brazil. We have no information on this, but juvenile recruitment appears to be restricted to certain periods.

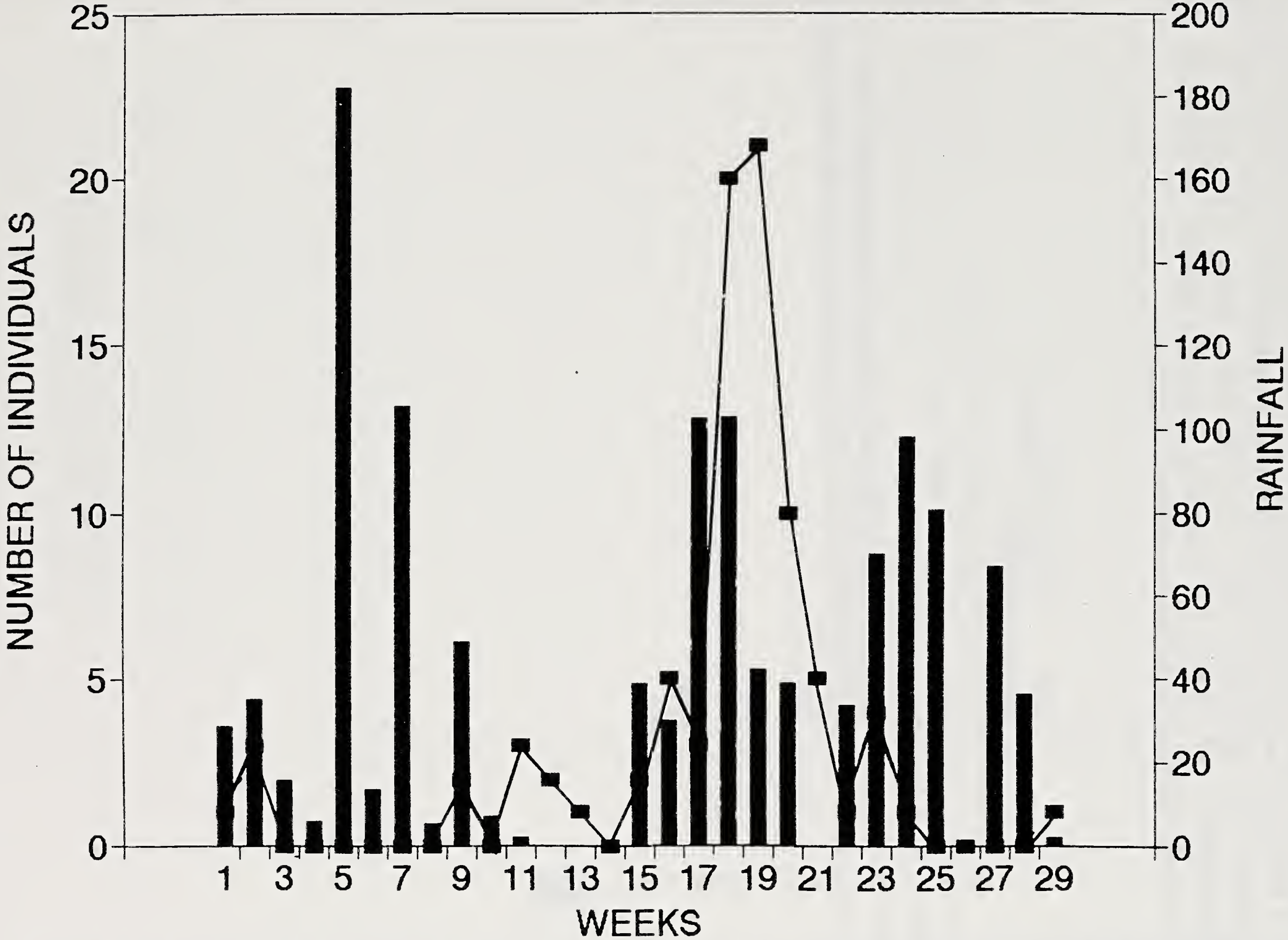

Fig. 3. Number of *Adenomera hylaedactyla* individuals caught from 12 Oct 1993 (week 1) through April (week 29) and amount of rainfall recorded for El Bagual Ecological Reserve (Argentina).

During October, November and December only adult males and females were captured. Juveniles appear in January and juvenile recruitment appears to be continuous through the rainy season (Fig. 4). Juveniles were divided into two categories, >17 mm SUL as subadults and juveniles *per se*, <17 mm SUL. The juveniles appearing from January and February are indicative of direct development occurring only in these months (mid-summer) (Fig. 4). Subadults make up most of the population from the end of January through March. Activity maybe decreased because of adverse climatic conditions.

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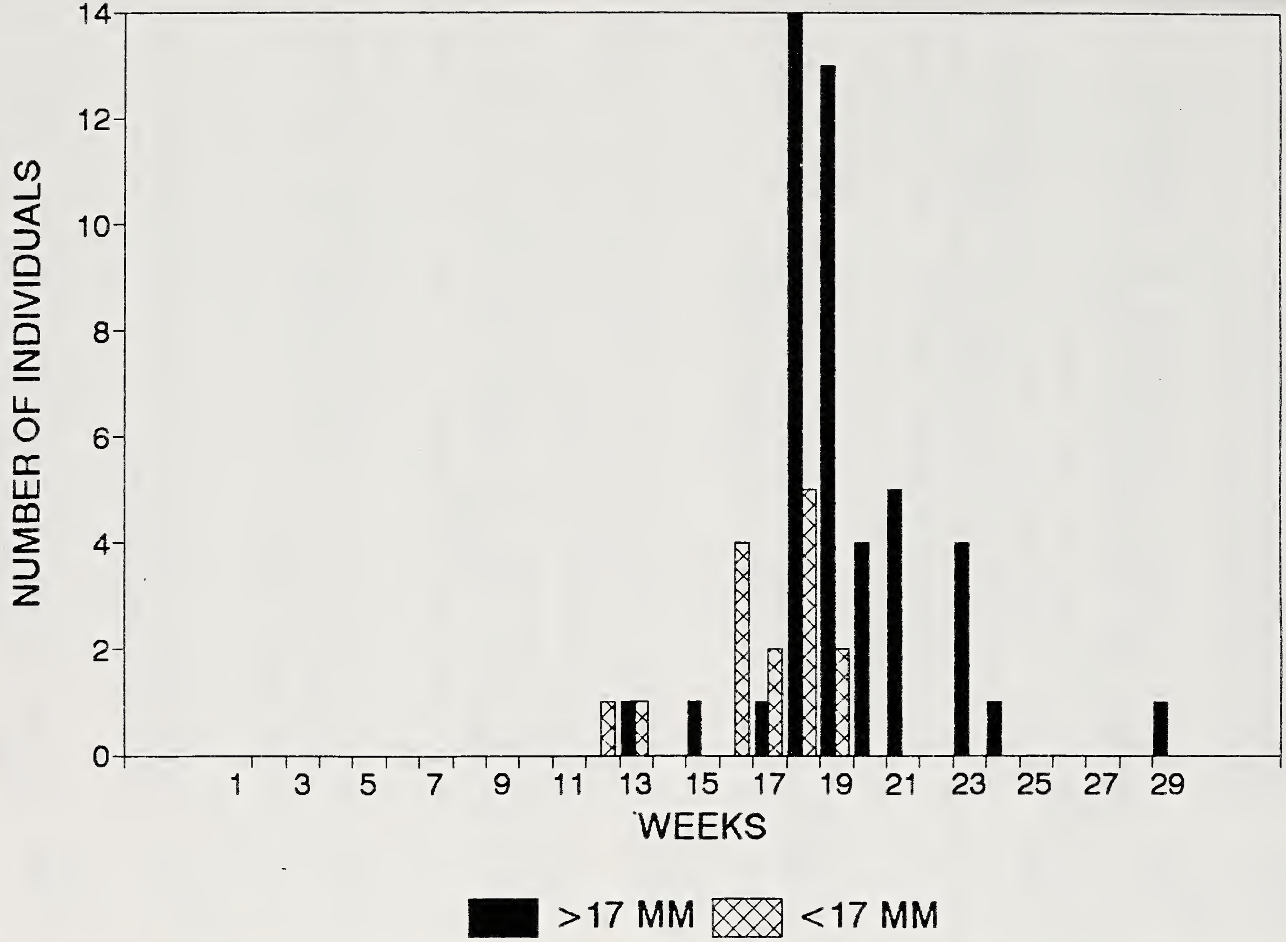

Fig. 4. Number of *Adenomera hylaedactyla* juveniles segregated in two snout-urostyile lengths (froglets and juveniles *per se*) for the 29- week sampling period at El Bagual Ecological Reserve (Argentina).

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THE ECOLOGY OF *LEPTODACTYLUS ELENAE* HEYER, 1978 (ANURA:LEPTODACTYLIDAE) IN A PROTECTED AREA IN SUBTROPICAL ARGENTINA

C. Mercolli, A. Alberto Yanosky and James R. Dixon

Leptodactylus elenae ecology is almost unknown and a population at El Bagual Ecological Reserve in northeastern Argentina was surveyed to obtain basic ecological information for the species. Data were obtained from animals taken from a drift fence system placed in three major habitat types. Sexual dimorphism in coloration is described. A total of 473 specimens, composed primarily of females and juveniles, were examined. A growth curve is given and size maxima reported. Forest habitats are preferred by this species and its presence is open areas is minimal. Calling occurs during daylight and the first hours after sunset, in coincidence with the heaviest rains. The species is active throughout the rainy season at El Bagual. Juvenile recruitment appears to be discontinuous and dates of metamorphosed hatchlings are given.

Data are compared with other related species, and these are the first continuously sampled ecological data for the species.

Introduction

Argentina harbors eight *Leptodactylus* species of the *fuscus* group (Cei, 1987). The species referred as *L. mystaceus* in Cei (1980) was changed to *L. elenae* after Heyer's description of this species (1978). *L. elenae* is considered a southern form of the *mystaceus* complex and ranges from Peru, through the Bolivian eastern slopes and Brazilian Matto Grosso, southward to the Argentine provinces of Salta, Corrientes and Jujuy (Cei, 1987; Gallardo, 1987). Yanosky *et al.* (1993) reported the species for El Bagual Ecological Reserve in the province of Formosa. Data for the species are scanty and occasional (Barrio, 1965; Duellman, 1978; Gallardo, 1964; Lutz, 1926), especially in the southernmost area of its range. More information is available for the closely related species *L. mystaceus* (Duellman, 1978; 1989; Rodrigues, 1992).

We herein present ecological data for *L. elenae* recorded at El Bagual Ecological Reserve, principally based on a drift fence system of captures. Data on movements, biomass and density will be presented later when we compare data for the entire amphibian fauna of the area.

Materials and Methods

Study area

El Bagual Ecological Reserve is a 3,463 ha protected area in the Province of Formosa, northeastern Argentina (26° 10' 53" S, 58° 56' 39" W), within the Humid Chaco biogeographical region. The Humid Chaco is characterized by grasslands and forests with an equilibrium maintained by naturally occurring floods and fires. Climatologically, the El Bagual meteorological station has recorded 1200 to 2000 mm annual rainfall. The actual amount of rainfall and its timing are highly unpredictable and consequently extreme drought or flood conditions may occur, most commonly during winter and summer, respectively (Fig. 1). Thermally, the annual mean temperature varies round 22°C (Fig. 1) with maximum average of 27°C and minimum average of 17°C. Extreme temperatures recorded for El Bagual Ecological Reserve are 45°C and -2°C (1988-1994).

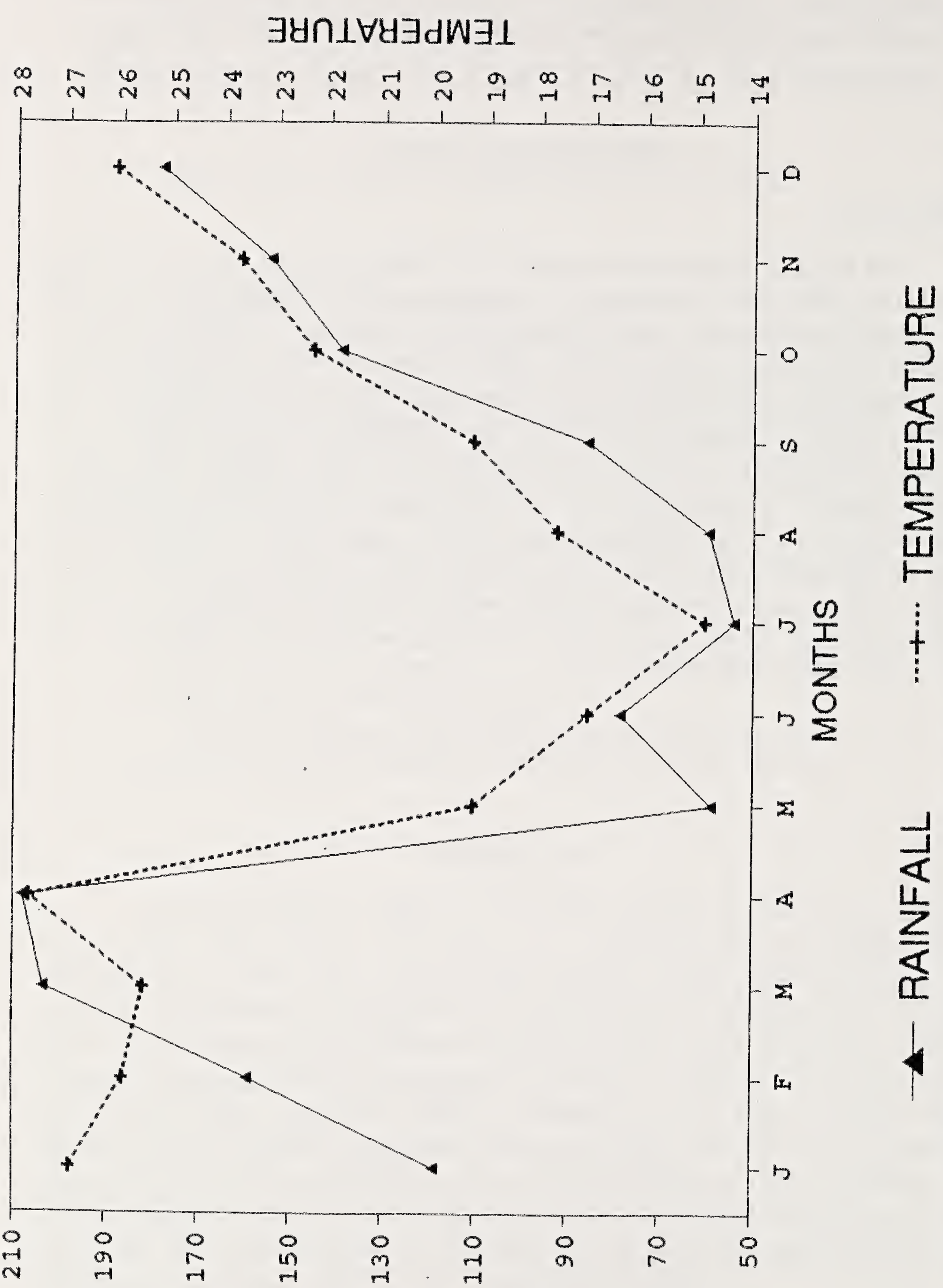

Fig. 1. Annual rainfall (mm) and temperature (C°) of El Bagual Ecological Reserve, Formosa, Argentina during the study.

El Bagual is characterized by "bañados" (flooded grasslands) interspersed with patches of variable woodland communities. Drift fences were installed in these woodlands but not in bañados. These woodlands were represented by: 1) Grasslands or shrubby savannas (Gr). Most of the grasslands in the reserve were formerly exploited for agriculture and subsequently abandoned; many of these areas have reverted to *Imperata* grasslands. Grasslands are composed principally of *Imperata, Schixachirium, Heimia* and *Solidago*. A few arboreal plants (e.g. *Prosopis, Copernicia, Acacia, Enterolobium* and *Tabebuia*) will colonize this habitat if flooding and burning are not permitted. These grasslands are rarely flooded. 2) Low forest (Lf). Woody habitat typically 15-17 m high. The upper arboreal stratum is composed primarily of *Gleditsia, Aspidosperma*, and *Diplokeleba*. The lower shrubby stratum is composed of *Acacia praecox, Eugenia uniflora* and *Allophylus edulis*, with an herbaceous layer dominated by *Bromelia serra* and *Aechmea disticantha*. 3) High forest (Hf). Climax, heterogeneous woody formation with a broad specific density and complete canopy bearing five stratifications, with the upper strata exceeding 20 m in height. The upper stratum is composed of *Tabebuia ipe, Phyllostylon, Enterolobium* and *Ruprechtia*. The fourth stratum is dominated by *Diplokeleba, Chlorophora* and *Pisonia*. Within the third stratum there appear *Eugenia pungens, Chrysophyllum, Ficus monckii* and *Syagrus*. The shrubby second stratum is composed of *Trichilia, Linociera* and *Sebastiania*. The lower herbaceous stratum is dominated by *Pseudoananas macrodonthes*. Epiphytic plants such as *Rhipsalis* cacti, *Thillandsia* spp. occur in all strata.

Patches of introduced *Eucalyptus* spp. are fairly widespread in eastern Argentina. The Eucalyptus forest, though not represented at El Bagual Reserve, some woody patches 35 years old were planted over an *Imperata* grassland to provide future timber at El Bagual Ranch. Another exotic tree in this habitat is *Melia azedarah*, which may affect the reserve because its seeds are widely disseminated by the Toco Toucan (*Rhamphastos toco*) and some species of psittacids.

Field work

Drift fence arrays (four fences per array) were deployed in three different habitat types and an effort was made to avoid flooding as much as possible. Habitats represented were high forest, low forest and grassland. Each fence was 15 m in length, composed of plastic coated fiber buried 10 cm underground and 40 cm in height, with one metallic funnel trap on each side at mid-point, and one buried 5 gallon bucket at each end. Each specimen captured was marked with a toe-clip according to Waichman's (1992) method, and snout-urostyle length (± 0.1 mm) (SUL), sex/age and body mass (± 0.1 g) were recorded. Captured specimens were released at the original site of capture. The sampling period extended from 18 October 1993 through April 1994. Results of sampling were summarized by weekly intervals (week 1 through week 28). During this sampling period 1034.2 mm of rainfall were recorded for the study site.

Throughout the study data were taken on calling males of *L. elenae* during both day and night hours, beginning the second week of November 1993 and continuing through April 1994.

Results

No report on external sexual dimorphism has been reported for the species, but Cei (1987) describes brown coloration in the lateral area of the gular region, after reporting the absence of nuptial pads. Perhaps Cei (1987) intended to report the color as dimorphism in males. We found that mature males of *L. elenae* have distinct black (dark brown in smaller males) lateral wedges in the gular area (as REB-20645). Based on this information, the smallest male recorded was 27.2 mm SUL, and all individuals over 27 mm SUL without dark color in the gular area were considered to be females. Any individual below 27 mm was considered a juvenile.

Twelve males, 219 females and 142 juveniles were captured along drift fences. Snout-urostyle lengths, body mass and habitat selected are shown in Table 1. A growth curve is shown in figure 2. Both males and females averaged 33 mm SUL with no evidence for size maxima for females, though the largest animal captured was a female 48 mm SUL with a body mass of 10.1 g. Female SULs showed higher variability than that of males. Body mass is also similar for both sexes, but male body mass showed greater variability than that of females (Table 1). Juveniles averaged 23.5 mm SUL and 1.26 g in body mass and variability of the data was similar to adults in SUL but less in body mass. The smallest juvenile captured was 13.8 mm SUL with a body mass of 0.2 g (Table 1, Fig. 2).

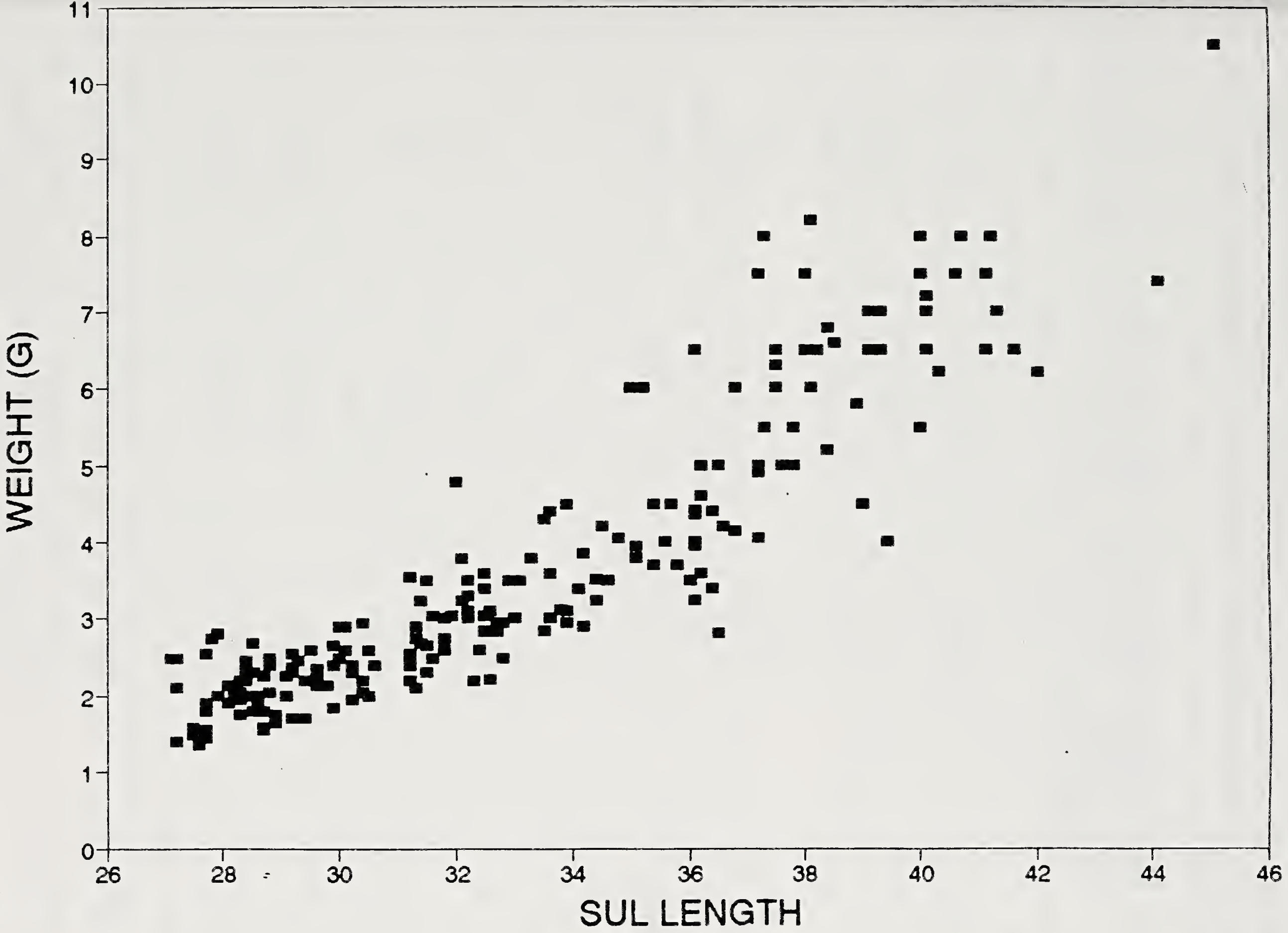

Fig. 2. Snout-urostyle length (mm) and weight (g) of all *L. elenae* captured during the study at El Bagual, Formosa, Argentina.

At El Bagual, high forest appears to be the habitat type preferred by all ages of *L. elenae*, between 54 and 61% of all captured specimens were found in high forest (Table 1). Low forest supported 31-35% and the grasslands the remaining 4-13%. This suggests a preference for closed woody habitat, though the presence of the species in open areas is not excluded.

Table 1. Snout-urostyle length, body mass, and habitat use of adult male, adult female, and juvenile *Leptodactylus elenae* from El Bagual Ecological Reserve, Formosa, Argentina.

SUL (mm)	Males	Females	Juveniles
n	12	219	142
X	33.31	33.03	23.50
SD	3.96	4.14	2.93
CV	11.88%	12.53%	12.34%
Range	27.2-45.0	27.1-48.0	13.8-27.7
Body Mass			
n	12	219	142
X	3.96	3.59	1.26
SD	2.28	1.84	0.78
CV	57.57%	51.25%	30.16%
Range	1.7-8.5	0.3-10.1	0.2-2.2
Habitat Use (%)			
High Forest	58.3	54.6	61.0
Low Forest	33.3	31.6	13.8
Grassland	8.0	13.8	4.0

Leptodactylus elenae males call from grass clumps and logs in woody areas. However, in flooded open areas males were partially submerged in water in dense vegetated sites and were recorded calling from these sites during most of the breeding season (Fig. 3). Calls extended from 15 Nov to 20 Dec 1993. Calls ceased for about a month and began again on 18 Jan 1994 and chorused continuously to 21 March 1994. The calls became sporadic until the first week of April, when chorusing ceased. Calls occurred continuously during daylight hours principally early in the morning and late in the evening and continued through the first three hours after sunset. Though calling was not quantified, it is clear that males call during rain periods and when the habitat is wet. Between the 10th and 13th weeks (21 Dec 1993 to 17 Jan 1994) no calls were recorded and there was a total lack of rainfall (Fig. 3). Calling was very sporadic from the 23rd week of sampling (22 Mar 1994) though rains were recorded. This may have been caused by the beginning of austral autumn with a decrease of the ambient temperature (Fig. 1).

General activity for the species is shown in Figure 4. The presence of *Leptodactylus elenae* was continuous from mid October through late April (late spring - early autumn) though general activity began to increase from late December, after the first heavy rains of the season (Oct-Nov). Juveniles appeared in the 8th week of sampling (early Dec) and were continuously present throughout the summer and early autumn. For determining the appearance of metamorphosed individuals in the habitat types, we divided the juvenile sample into two age classes according to the juvenile average (Table 1, X=23.5 mm SUL): <23.5 mm and > 23.5 mm SUL. Metamorphosed juveniles first appeared in the 8th week and were almost of continuously present to the 22nd week (mid March). Larger juveniles (>23.5 mm SUL) appeared one week later but were continuously present to the end of the sampling period. Table 1 shows habitat preference for both age classes of juveniles. The <23.5 mm SUL first appeared in the high forest in early December and the same age class in the low forest appeared in late January. The representation of this age-class in the grassland is very poor, indicative of absence of metamorphosed *L. elenae* in the grassland and egg laying probably did not occur in this habitat type. The >23.5 mm SUL juveniles was primarily active during 9-11th week in the high forest for segregating between both high and low forest in the rest of the sampling period and lack of records for the grassland.

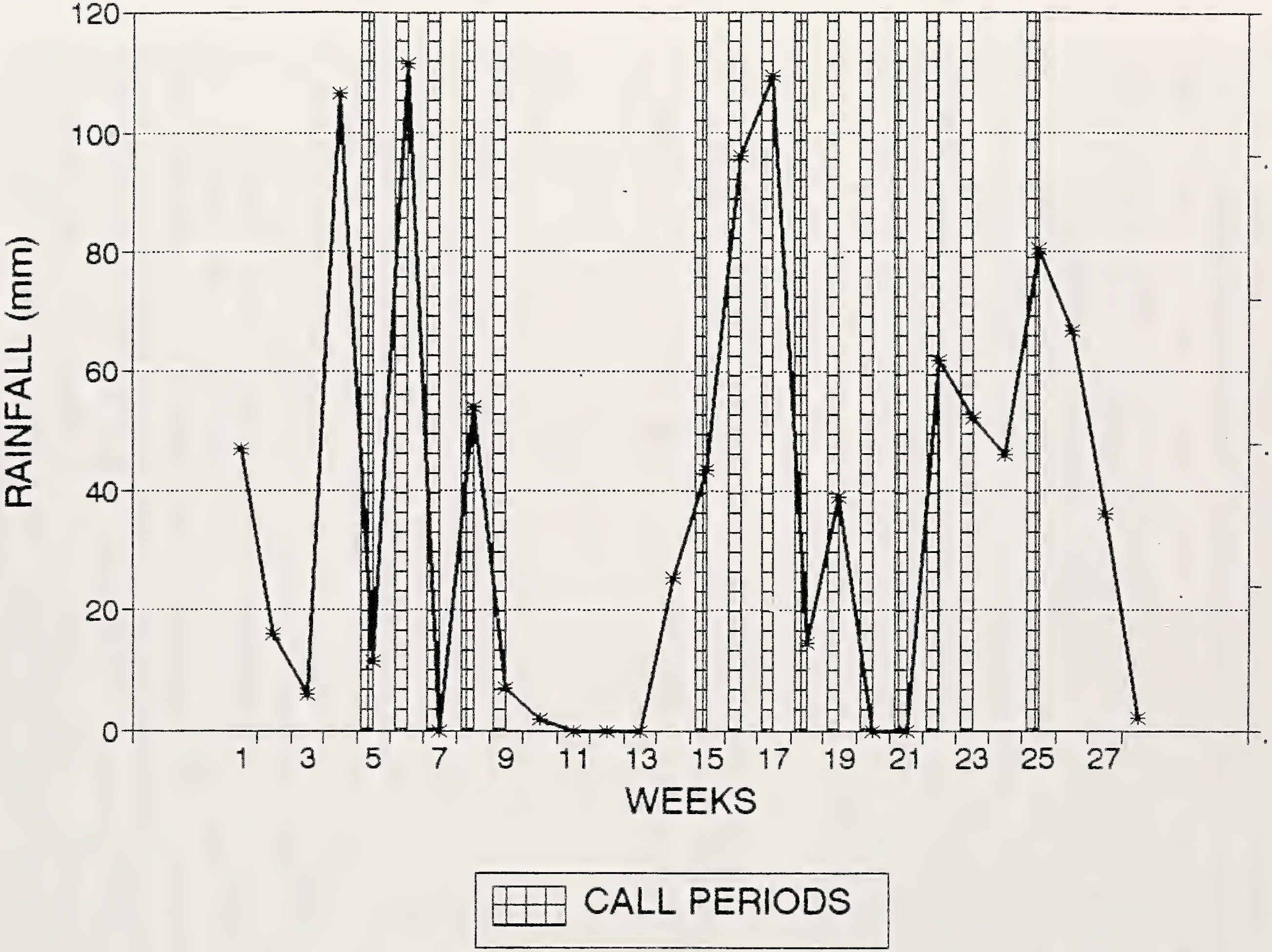

Fig. 3. Frequency of *L. elenae* male volcalization during a 28 week activity period at El Bagual, Formosa, Argentina.

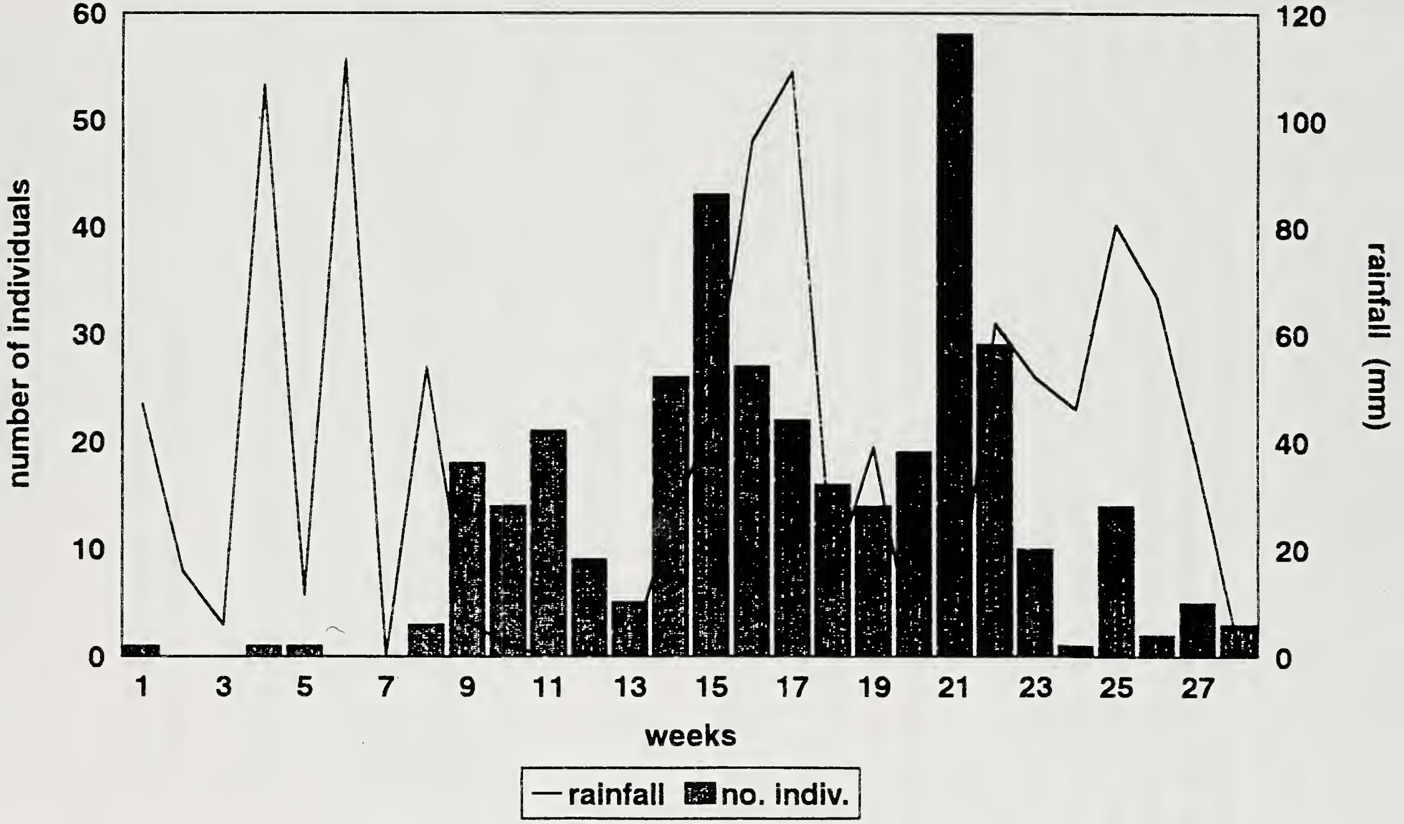

Fig. 4. Weekly capture rates of all individuals of *L. elenae* over a 28 week activity season plotted against recorded rainfall.

Discussion

Rodrigues (1992) characterized *Leptodactylus mystaceus* in Amazonian Peru as averaging 54.95 mm SVL and 15.3 g in body mass for preserved males; a species inhabiting flooded areas principally, but also forested areas; a nocturnal, terrestrial, generalist in feeding habits; a foam nester but with aquatic tadpoles. Though *L. elenae* is a closely related species to *L. mystaceus*, sexually mature El Bagual specimens never attained the length recorded for individuals from Peru. Duellman (1989) determined that this species to be terrestrial, with lentic foam nests and lentic tadpoles. Although we did not find nests nor mating individuals of this species, we suspect mating and nesting probably occurs in low and high forested areas of El Bagual, predominantly the latter. This foam nest species probably lays its eggs in temporary pools within forest sites.

Leptodactylus elenae is a ground level inhabitant active most of the day, with males calling during the morning, evening and at night at El Bagual, suggesting females are probably active at the same time. This type of day activity is not reported for related species, such as *Leptodactylus fuscus* for which Heyer *et al.* (1990) mentioned as a terrestrial, nocturnal, sit-and-wait feeding specialist in Brazil.

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OCCURRENCE OF THE GROUND SKINK, *SCINCELLA LATERALIS*, IN QUEEN ANNES COUNTY, MARYLAND AND A COMMENT ON ITS REPRODUCTIVE CYCLE

John D. Groves and Arnold W. Norden

The distribution of the ground skink, *Scincella lateralis* in Maryland was last reviewed by Harris (1975). On the eastern shore of Maryland he reported it from Dorchester, Wicomico, Somerset and Worcester Counties. He also commented on a specimen seen at Trappe, Talbot County, Maryland by Peter Wemple. Since little is known concerning this skink in Maryland, and no new information has been published since 1975, the following notes may be of interest.

On 6 September 1972 we collected a hatchling (ca. 50 mm TL) *Scincella lateralis* under a discarded cinder block at the west end of a large lake, in a wooded section along routes 50 and 301 (combined), near Graysonville, Queen Annes County, Maryland. Having no reason to retain this specimen, it was examined and released at the capture site. This locality is in the upland forest section of the eastern shore, which is chiefly composed of mixed loblolly pine/oak-hickory forests (Stewart and Robbins, 1958).

This observation helps to substantiate the sighting of this skink by Peter Wemple (reported in Harris, 1975) from Trappe, Talbot County, Maryland. Although this record appears to represent a new county record for this species and is the most northern station reported for this skink on the Delmarva peninsula, it has long been known from the Pine Barrens in New Jersey (Stejneger and Barbour, 1943; McCauley, 1945; Conant 1979) and should be looked for on the coastal plain in the upper eastern shore of Kent and Cecil Counties. In Delaware it has been reported from central Sussex County (See Harris, 1975) at a location south of the present record.

The fact that this specimen was a hatchling when found suggests that, in Maryland, as with more southern portions of its range (Fitch and Greene, 1965), it may produce more than one clutch of eggs each season. In more southern areas, the ground skink is common, but is easily overlooked by most investigators, due to its secretive habits, often quickly disappearing under leaf cover before they are seen. It is a relatively cold tolerant species, being restricted to localities below 40 degrees north Latitude (Fitch, 1967). It emerges early in spring and remains active until late in the fall. Mating occurs shortly after spring emergence, with egg laying occurring shortly afterwards. In the southern portion of its range, two to four clutches are produced in a season, usually beginning in late April or early May, with additional clutches being produced at five week intervals (Fitch and Greene, 1965). In the northern portion of its range, records of the reproduction of this species are scanty, but Fitch and Greene (1965) suggest that the growing season may be long enough to allow multiple clutches in some localities. Fitch (1967) states that, in northern Kansas, two clutches per season seem to be most frequent. In West Virginia Green and Pauley (1987) suggested that several clutches may be produced in a season and recorded a single clutch that was produced on 24 June 1963. Smith (1961) had a female deposit eggs on 21-22 June and found a clutch of eggs in July, in Illinois. Anderson (1965) recorded a single female from Missouri, that produced a clutch of four eggs on 31 May and a second clutch of three eggs on 22 June. Fitch (1970) believes that this 22 day interval between clutches is the minimum amount of time between egg clutches for this species.

McCauley (1945) recorded the only information on the reproduction of this species in Maryland. He reported finding five eggs of this species near Blackwater Refuge, in Dorchester County, that were about 18 inches above the ground in the rotten interior of an old stump. These eggs were incubated in captivity and two hatched young were discovered on 30 August, "apparently hatching a day or so previously". The three remaining eggs had addled, but contained developing young. The late dates of hatching provided by McCauley (1945) and the presence of the above recorded hatchling, suggests that more than one clutch of eggs may be produced by this species in Maryland.

Although this species grows rather quickly, particularly in the early weeks of life (Fitch and Greene, 1965), the size of this specimen indicates that it was no more than two or three weeks of age, apparently hatching in mid to late August, with egg laying occurring in July. If the growing season for this species in Maryland is slightly more than five months (April through September), it is possible that at least two clutches are produced each year, one in late April or May and another in July or August, with additional clutches possibly being produced during more favorable years. This is primarily based on the fact that incubation takes between a little less than one month to a little more than two months, as well as having a period of from 22 days to five weeks between egg clutches (Fitch, 1970). This is also supported by the fact that embryonic development in *S. lateralis* is advanced at the time of egg-laying (Fitch, 1970). Although a more northern latitude may compress the reproductive cycles of this species, as a result of a shorter growing season than more southern latitudes, there are no reasons that suggest that the reproductive biology of this species in Maryland differs from populations in northern Kansas or West Virginia. Additional information on the reproduction of this skink in Maryland is needed to confirm these observations.

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NOTES ON AQUATIC TURTLES OF THE RIO GRANDE DRAINAGE, NEW MEXICO

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Distributional and habitat use data are presented for six species of aquatic turtles (*Chelydra serpentina, Chrysemys picta, Pseudemys gorzugi, Trachemys gaigeae, Trachemys scripta,* and *Apalone spinifera*) from the Rio Grande and a tributary (Jemez River) in New Mexico.

Few studies have been made of the aquatic turtles of the Rio Grande drainage system in New Mexico. Degenhardt and Christiansen (1974) summarized much of the available information on the distribution and habitats of the Rio Grande turtle fauna in the state. However, collecting efforts and field observations in recent years have provided new information for several species in the river system. Herein I provide data for six species in the middle and upper parts of the Rio Grande in New Mexico based on previously unreported material in the University of New Mexico Museum of Southwestern Biology (MSB) and observations by field biologists. Most localities mentioned in the text are indicated in Figure 1; all elevations provided for localities are riverbed elevations (in m). Sizes of specimens are given as straight-line carapace length measured along the midline (in mm).

Chelydra s. serpentina (Common Snapping Turtle)

Snapping turtles were not known to occur in the Rio Grande until Stuart and Painter (1988) reported specimens collected at La Joya State Game Refuge, Socorro County, and near Isleta, Bernalillo County, in 1978 and 1987, respectively. Stuart and Clark (1991) subsequently reported an adult turtle taken from the Jemez River just above its confluence with the Rio Grande in southern Sandoval County in 1991; they also noted a photographic record of an adult *C. serpentina* collected in the Rio Grande in northwest Albuquerque, Bernalillo County, in 1981.

Two additional records are available from Bernalillo County. On 4 August 1993, a snapping turtle (MSB 56303) was collected by C. S. Altenbach and B. K. Lang in the Rio Grande in southwest Albuquerque, ca. 5.5 km downstream of the State Highway 500 bridge. This turtle, a subadult (109 mm), is the smallest specimen available from the Rio

Grande and may be indicative of a reproducing population. On 23 April 1994, an adult *C. serpentina* (ca. 300 mm) was observed by N. Runyan and C. S. Altenbach in a pond at the Rio Grande Nature Center in northwest Albuquerque but was not collected.

Chelydra serpentina was recently discovered on the Bosque del Apache National Wildlife Refuge in Socorro County, the southernmost locality record for this species in the Rio Grande. In April 1992, L. M. Ellis found and photographed an adult *C. serpentina* crossing a levee road between a ditch and an artificial marsh on the refuge. The same turtle or another adult was observed in a drying canal about 1 km from the first locality on 20 June 1993 (Y. D. Chauvin, pers. comm.).

Chelydra serpentina from other New Mexico river systems (such as the Pecos) appear to prefer lentic waters where aquatic vegetation is present (Degenhardt and Christiansen, 1974). Snapping turtles from La Joya, Isleta, and Bosque del Apache were found in or near riverside marshes with extensive emergent vegetation and deep mud bottoms. The Jemez River specimen was found near a deep stilling basin at the foot of a large dam. Of the three turtles found at Albuquerque, two were in the sand- or gravel-bottomed river channel and the third was in a small artificial pond excavated in the flood plain.

The status of the snapping turtle as native or introduced in the Rio Grande is problematic. Although I am aware of a recent release of an adult snapping turtle at the La Joya Refuge (subsequent to the collection reported by Stuart and Painter, 1988), it is unlikely that liberated turtles alone can account for all of the available records. If *C. serpentina* is not native, as might be inferred from the lack of records for the lower Rio Grande in Texas and México (Smith and Smith, 1979; Dixon, 1987), then the species has probably become established in the drainage in recent years.

Chrysemys picta belli (Western Painted Turtle)

Degenhardt and Christiansen (1974) noted that the painted turtle has an essentially continuous distribution in the Rio Grande from Bernalillo downstream to the Texas border, and also occurs as an apparently disjunct population in the Rio Grande at Española, Rio Arriba County. This distributional pattern was attributed to the lack of preferred habitat (e.g., riverside ponds and marshes) in much of the upper Rio Grande.

Records of C. *picta* are now available from upstream of Bernalillo in Sandoval County. Observational data indicate that the main Rio Grande population extends as far upstream as the reach below Cochiti Reservoir (ca. 1590 m elevation; V. J. Hink and R. D. Ohmart, in litt.; pers. obs.). Two specimens also are available from this section of river: one from a farm pond at Sile, ca. 1585 m (MSB 33418), and another from farther downstream, near Algodones (MSB 50115). In addition, a C. *picta* (MSB 51848) was trapped in 1989 in the Jemez River below Jemez Canyon Dam (1567 m), 4.5 river km above the confluence of the Rio Grande. This is the first confirmed record of C. *picta* from a tributary of the Rio Grande in New Mexico, although there is also a questionable specimen (MSB 11618) collected in 1949 at Correo, Valencia County, a site located west of Isleta on the Rio San Jose.

The distribution of C. *picta* upstream of Cochiti Reservoir is apparently more extensive than previously believed. On 12 July 1989, C. S. Clark and I observed a painted turtle basking on the river bank at ca. 5.2 river km above Pilar (ca. 1842 m), Taos County, approximately 50 river km upstream of the Española population. Clark (pers. comm.) observed an unidentified emydid turtle in this same area the previous year. Subsequent trapping efforts in 1989 in the rocky, fast-flowing channel above Pilar failed to produce turtles.

Records of C. *picta* are most numerous from reaches of the Rio Grande where quiet waters are present, but this is partly an artifact of collecting effort. Much of the river channel above Cochiti Reservoir (such as upstream of Pilar) is confined to steep-sided, rocky canyons where the riparian zone is extremely narrow and lentic waters, such as flood plain ponds, are usually absent. *Chrysemys picta* may be present at least in small numbers in these lotic situations, but may be difficult to trap due to the swift current. The series of specimens from Española reported by Degenhardt and Christiansen (1974) was taken in an oxbow pond and a ditch near the Rio Grande (J. L. Christiansen, in litt.), not in the river.

Pseudemys gorzugi (Rio Grande Cooter)

The Rio Grande cooter occurs in the Rio Grande drainage in Texas and México (downstream of Big Bend) and the Pecos River drainage in southeastern New Mexico and western Texas (Ernst, 1990). On 22 June 1994, an adult female P. *gorzugi* (MSB 56849; 257 mm) was collected in an artificial pond on the Bosque del Apache National Wildlife Refuge. The pond was well-vegetated with submergent aquatic plants. Based on the known distribution of *P. gorzugi*, this specimen was probably a liberated captive and is not indicative of a population on the refuge or in the Rio Grande of New Mexico.

Trachemys gaigeae (Big Bend Slider)

Available records of the Big Bend slider from New Mexico suggest that the species occurs intermittently along the Rio Grande from the Bosque del Apache National Wildlife Refuge southward to the Texas border (Ernst, 1992). As little information on habitat is available for New Mexico populations (Degenhardt and Christiansen, 1974), the following data are provided.

Big Bend sliders on Bosque del Apache were collected in ditches and artificial wetlands within 2 km of the river. Preliminary data from an ongoing mark-recapture study on the refuge suggest that *T. gaigeae* occurs most commonly in permanent or near-permanent ponds with substantial growth of pondweed (*Potamogeton* and *Zannichellia* spp.) and filamentous algae and a moderate accumulation of dead organic material. Sliders also were occasionally found in ca. 1 m deep, fast-flowing ditches in the vicinity of these ponds. Water in both situations was often turbid with suspended silt. *Trachemys gaigeae* was less often trapped in shallow (1 m deep or less), semi-permanent marshes which were well-vegetated with emergent plants (*Typha* sp. and *Scirpus* sp.). The water in these marshes was darkly turbid and the bottom was soft, black mud. *Chrysemys picta* was typically abundant in such marshes; one hoop trap captured 42 painted turtles and one Big Bend slider. The near absence of submergent aquatic plants in many of these highly anaerobic marshes may limit their use by *T. gaigeae*, whereas the deeper ponds used by sliders were usually well-vegetated with this food source.

Trachemys gaigeae was collected and observed during 1992-93 in the highly-modified reach of the Rio Grande between Elephant Butte and Caballo reservoirs. Specimens from immediately upstream of Caballo

Reservoir were trapped both in the lotic main channel and lentic side channels of the Rio Grande. Benthic releases from Elephant Butte Reservoir resulted in cold water temperatures in the river even during the summer. During May 1992 at a trap site ca. 19 river km below the dam, water temperatures taken throughout the day in the main channel were 12-15 deg C, while temperatures in an adjacent side channel were 15-23 deg C. Although these side channels dried up during winter when water releases were decreased, they were frequented by *T. gaigeae* during the summer when submergent vegetation was abundant. A specimen (MSB 56299) collected on 10 November 1993 in the scoured, rock-bottomed stilling basin below Elephant Butte Dam provides additional evidence that *T. gaigeae* can tolerate highly-modified conditions in this part of the Rio Grande.

On Bosque del Apache, Big Bend sliders were almost always trapped with *Chrysemys picta* and were infrequently taken with *Apalone spinifera; Trachemys scripta* (see below) also was found occasionally with *T. gaigeae* on the refuge. Between Elephant Butte and Caballo reservoirs, *T. gaigeae* was the most frequently trapped turtle, *A. spinifera* was present but apparently less common than *T. gaigeae,* and *C. picta* was not observed or trapped.

An adult *T. gaigeae* apparently was collected at La Joya State Game Refuge in the 1970s and preserved, but the specimen currently cannot be located (C. W. Painter, pers. comm.). No Big Bend sliders were captured during subsequent trapping efforts at this site in the 1980s and early 1990s (C. W. Painter and J. N. Stuart, pers. obs.), and there is no evidence that a population exists at La Joya.

Trachemys scripta (Slider)

Degenhardt and Christiansen (1974) reported specimens of *Trachemys scripta elegans* (red-eared slider) from the Rio Grande in Doña Ana and Sierra counties and stated that this slider is probably introduced in the drainage. Since then, the subspecies has been collected in Socorro County (near Escondida; MSB 34222) and Bernalillo County (Albuquerque; MSB 33933). *Trachemys scripta elegans* appears to be established at Elephant Butte Reservoir (C. W. Painter, pers. comm.), but other records from the river may not represent reproducing populations.

The reported co-occurrence without gene exchange of *T. scripta elegans* and *T. gaigeae* in the Rio Grande (noted by Ernst, 1992) requires further examination. Three non-melanistic male *Trachemys* (MSB 56851-852 and 58205; 142-190 mm) collected in syntopy with *T. gaigeae* on Bosque del Apache National Wildlife Refuge in 1994 have some morphological characteristics of *T. scripta elegans* (red ear stripe; long nails on forefeet), yet have other features strongly suggestive of local *T. gaigeae* (light lines on carapacial scutes more vermiform than straight and orange in color; plastron orange; whorls of plastral pattern lacking extensive melanin). The identity of these apparent hybrids is currently being assessed using electrophoretic and morphometric analyses (M. E. Seidel, pers. comm.)

An apparently introduced specimen of *T. scripta scripta* (yellow-belly slider) was collected at Bosque del Apache in 1994 (Stuart, 1995). There is no evidence that this subspecies is established in the Rio Grande drainage.

Apalone spinifera emoryi (Texas Spiny Softshell)

Spiny softshells appear to have a nearly continuous distribution in the Rio Grande of New Mexico from the Texas border upstream to Sandoval County. Degenhardt and Christiansen (1974) reported Bernalillo as the northernmost (and highest) collecting station in the Rio Grande. V. J. Hink and R. D. Ohmart (in litt.) reported observations (but no specimens) of softshells from as far upstream as the outlet channel below Cochiti Dam (ca. 1590 m).

In May 1989, C. S. Clark and I collected specimens from the Rio Grande near Santo Domingo Pueblo (1577 m; MSB 51846) and above San Felipe Pueblo (1564 m; MSB 51847) and observed other softshells in the Santo Domingo - San Felipe reach below Cochiti Dam. Despite pronounced degradation (loss of fine sediments) in the river channel since closure of the dam in 1975, softshells appear to be common from Cochiti to San Felipe, particularly in areas where intermittent tributaries (arroyos) have deposited sand bars. In much of this reach, however, the river channel is entrenched and the bottom is typically stone- or gravel-covered.

Softshells are not known to occur upstream of Cochiti Dam. No aquatic turtles were observed during intensive field work at Cochiti Reservoir in 1987 (pers. obs.). In the Pecos River of New Mexico, *A. s. emoryi* is common up to at least 1548 m elevation (near Dilia, Guadalupe County; pers. obs.), and a specimen was taken at 1550 m in the Gallinas River, a Pecos tributary (Stuart, 1988). Although Cochiti Dam has been a barrier to turtle movement since the mid-1970s, it also may be located near the natural upper elevational limit for *A. s. emoryi* in the Rio Grande.

Spiny softshells also occur in the lower Jemez River below Jemez Canyon Dam. Several *A. spinifera* were observed in the stilling basin below the dam on 30 June 1991 (pers. obs.), but I have no evidence that they occur in Jemez Canyon Reservoir or areas farther upstream. Water diversion and aggradation of the riverbed above the reservoir likely would discourage or prevent upstream movement of any turtles that may be present in this impoundment.

Comments

Two other aquatic turtles have been reported from the Rio Grande in New Mexico for which I have no pertinent information. Degenhardt and Christiansen (1974) provided records of *Kinosternon flavescens flavescens* (yellow mud turtle) from the Rio Grande downstream of Caballo Dam in Sierra and Doña Ana counties. Price and Johnson (1978) reported a single specimen of *Malayemys subtrijuga* (Malaysian snail-eating turtle), a Southeast Asian species common in the pet trade, which was collected at Elephant Butte Dam in 1968.

In total, eight species of aquatic turtles have been reported from the Rio Grande drainage in New Mexico. Of these, four are known to be native (*Kinosternon flavescens, Chrysemys picta, Trachemys gaigeae,* and *Apalone spinifera*), two may be established via introductions (*Chelydra serpentina* and *Trachemys scripta*), and two are exotics which have been reported from, but are probably not established in, the New Mexico portion of the Rio Grande (*Malayemys subtrijuga* and *Pseudemys gorzugi*). Of the species known to be native, *C. picta* attains the highest elevation (northernmost limit) in the drainage, followed in order by *A. spinifera, T. gaigeae*, and *K. flavescens*. Almost all locality records of aquatic turtles in the drainage system are from the mainstem Rio Grande or its flood plain. However, three species (*C. serpentina, C. picta*, and *A. spinifera*) also have been collected or observed in the lower Jemez River.

Little detailed information is available on the status of most turtle species in the Rio Grande. The construction of large dams on the river during this century has resulted in fragmentation of river habitat and its associated turtle populations (Cochiti, Jemez Canyon, Elephant

Butte, and Caballo dams are all structures of sufficient size to act as barriers to aquatic turtles). However, due in part to a lack of studies, there is presently no compelling evidence that any turtle species has declined in abundance or distribution in this drainage. *Chrysemys picta*, for example, has not been shown to be "depleted and threatened in [the] Rio Grande" (Stebbins, 1985:101); painted turtles are still commonly encountered throughout the river valley and no quantitative data exist to suggest a decline. Nonetheless, with the recent explosive growth of New Mexico's human population, a thorough study of this turtle fauna should be undertaken to determine how increasing urban development and water use in the Rio Grande Valley may affect these species.

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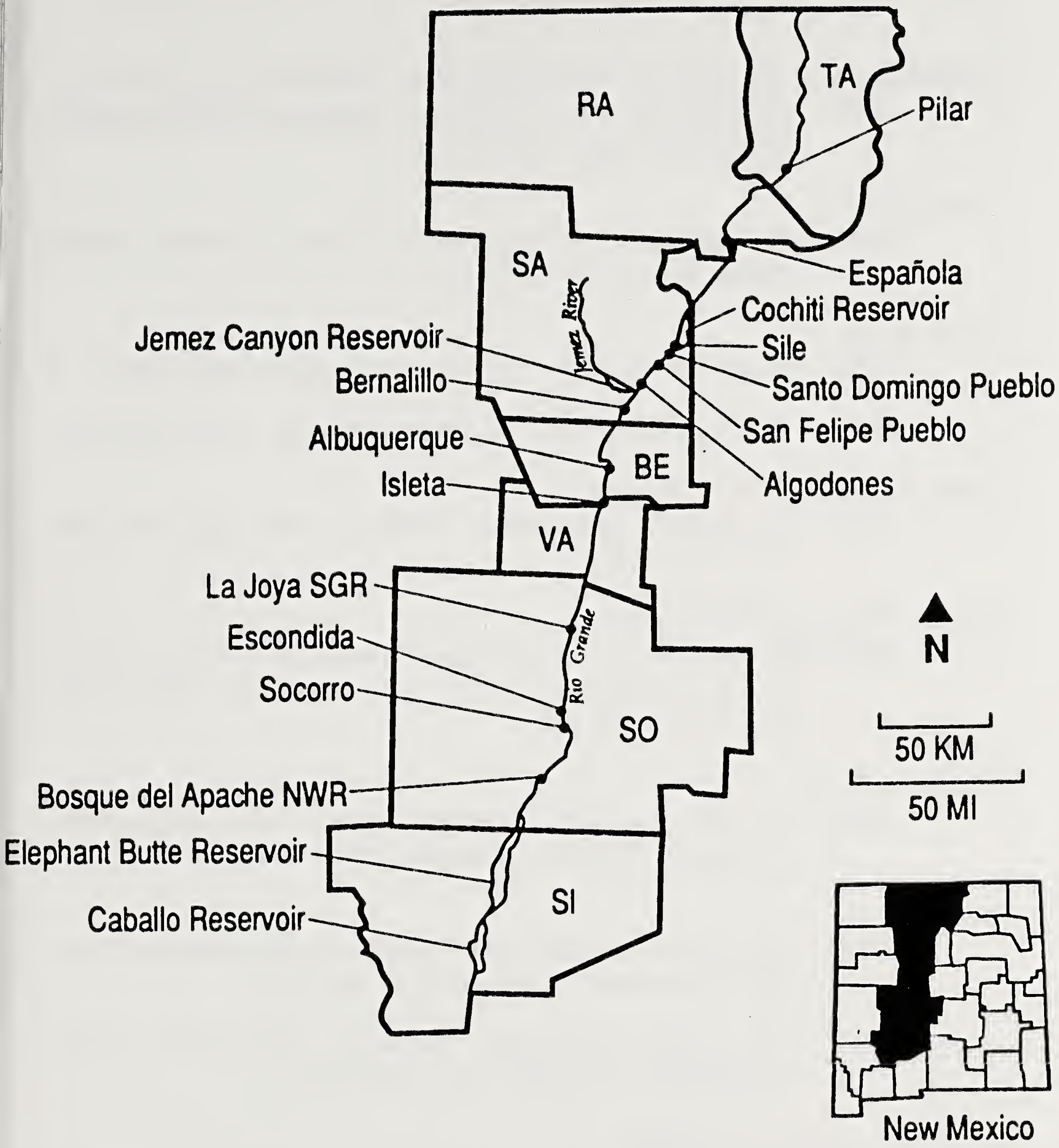

Fig. 1. Localities of specimens and observations from the Rio Grande drainage discussed in text. Inset map shows location of the study area in New Mexico. Counties included are Bernalillo (BE), Rio Arriba (RA), Sandoval (SA), Sierra (SI), Socorro (SO), Taos (TA), and Valencia (VA).

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SNAKES OF THE GENUS *ERYTHROLAMPRUS* (SERPENTES: COLUBRIDAE) FROM TRINIDAD AND TOBAGO, WEST INDIES

Jerry D. Hardy, Jr. and Hans A. E. Boos

Introduction

The genus *Erythrolamprus* Wagler, 1830, contains seven or eight species of brightly-colored Central and South American snakes most of which are thought to be coral snake mimics. Greene and McDiarmid (1981) have shown that the color pattern of *Erythrolamprus guentheri*, a species of eastern Ecuador and Peru, varies in relation to the color patterns of thosë species of coral snakes (*Micrurus*) with which it occurs sympatrically. More recently Marques and Puorto (1991) suggested the same relationship between populations of *E. aesculapii* and three Brazilian species of *Micrurus*. The mimicry phenomenon, and the resulting increased probability of intra-specific variation which it implies, adds considerable difficulty to studies of this poorly understood genus.

In order to interpret our material from Trinidad and Tobago, it was necessary to briefly review distributional and meristic data for two species, *Erythrolamprus aesculapii* and *Erythrolamprus bizona*. This review was based on exisiting literature as well as an examination of specimens in the collection of the Division of Amphibians and Reptiles, United States National Museum of Natural History, Washington, D. C.

Erythrolamprus aesculapii is primarily a species of Amazonian South America. It has been recorded from Colombia and Venezuela southward to Bolivia and Misiones, Argentina. *Erythrolamprus bizona* is known only from Costa Rica, Panama, Colombia, and Venezuela (Peters and Orejas-Miranda, 1970; Roze, 1966). These two species are broadly sympatric in Colombia (Perez-Santos, 1986). Both species occur in Venezuela, but their Venezulean ranges appear to be intirely allopatric (Roze, 1966). There is no distributional overlap in Panama (Auth, 1994; Smith, 1958) or Costa Rica (Savage, 1980; Savage and Villa R., 1986).

Erythrolamprus aesculapii and *Erythrolamprus bizona* are typically distinguished from one another on the basis of differences in subcaudal counts (Lancini, 1979; Lancini and Kornacker, 1989; Peters and Orejas-Miranda, 1970; Roze, 1966). The presence of a nuchal band in *E. bizona*

(Fig. 1) also appears to be a distinguishing character (Dunn and Bailey, 1951; Lancini, 1979; Lancini and Kornacker, 1989; Savage and Villa R., 1986). We have therefore plotted our subcaudal and ventral counts against the presence ("E. *bizona*") or absence ("*E. aesculapii*") of a nuchal band. Our results, which differ markedly from published data, suggest the possible need for a redefinition of these two species. We plan to continue this work and to publish our results at a later date. Meanwhile, as a consequence of our recent findings, we have been extremely cautious in the use of meristic data as it applies to our work in Trinidad and Tobago.

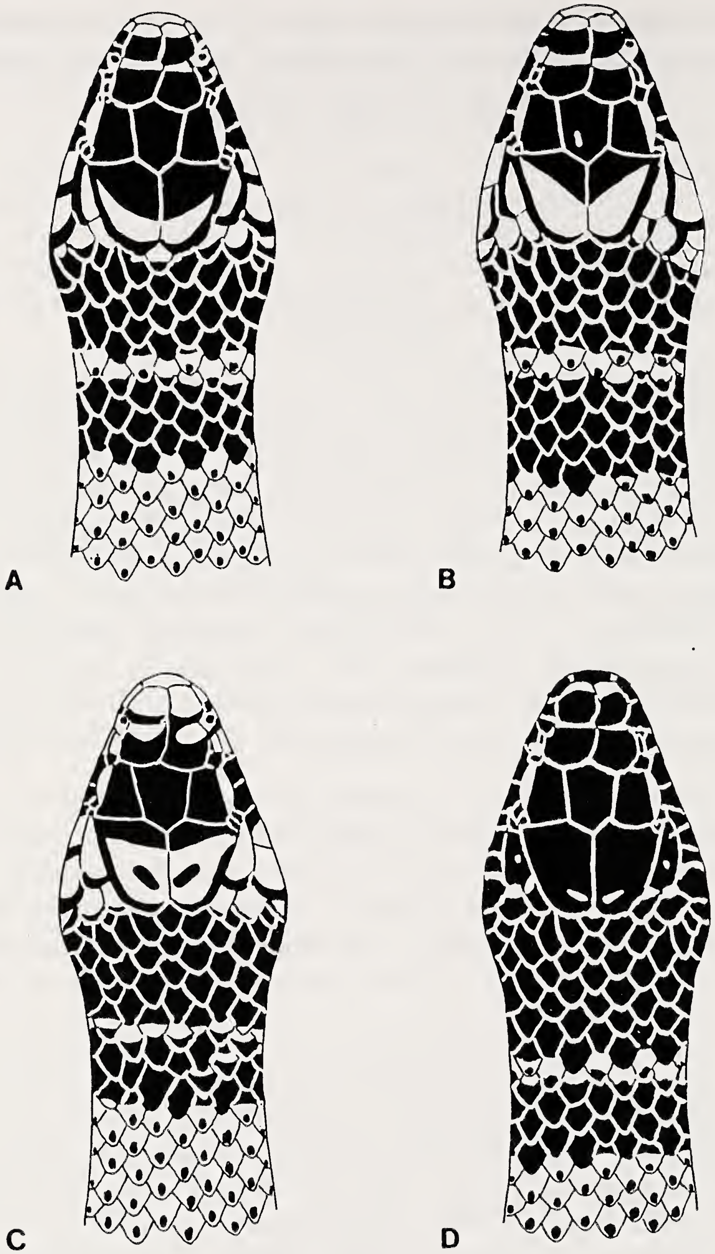

Fig. 1. *Erytholamprus bizona.* Variations in head pattern. A. USNM 148015, Costa Rica. B. USNM 55334, Venezuela. C. USNM 195915, Colombia. D. USNM 140701, Panama. Note extreme reduction of the post-ocular light band in this specimen.

Historical Background

Trinidad. Schmidt (1957), in his review of the coral snakes of Trinidad, presented the first published evidence of the occurrence of the genus *Erythrolamprus* on the island: "The venomous *Micrurus* can readily be distinguished from the non-venomous snakes of Trinidad, that also have a pattern of black, red, and yellow rings, by the fact that the black rings of the harmless "*Erythrolamprus* are in pairs, ..." In the same paper, he presented a photograph of *Erythrolamprus aesculapii*". Although no data accompanied the photograph, the museum tag is visible and shows three partially obscured lines of print. The first says "Ry." (possibly an abbreviation for Royal) followed by and "I" or part of a "V" (possibly indicating Institute or Victoria), the second says "10 No" (possibly part of a date), and the third clearly says "Trinidad". In his text Schmidt acknowledged borrowing specimens of snakes from Arthur Greenhall, then Director of the Royal Victoria Institute in Port of Spain, Trinidad. Emsley (1963), in his comments on *Erythrolamprus aesculapii* in Trinidad, briefly mentioned what we presume to be the same specimen: "One specimen collected from Trinidad is lodged with the Royal Victoria Institute, Port of Spain, Trinidad, W. I.".

Tobago. The genus *Erythrolamprus* was known from Tobago for decades before its discovery on Trinidad, but the Tobago snake was not properly identified until 1966. Peters' description of *Erythrolamprus ocellatus* was based on a single specimen which lacked locality data (Peters, 1868). Emsley (1966a) compared Peter's type specimen and two similarly-marked specimens in the British Museum (which also lacked locality data) to seven specimens of *Erythrolamprus* known to have come from Tobago. He concluded that all of these specimens were identical, thus establishing Tobago as the type locality of *Erythrolamprus ocellatus* and clearly identifying the Tobagonian *Erythrolamprus* as *E. ocellatus*. He then compared his Tobago material to the single specimen of *Erythrolamprus* in the Royal Victoria Institute, and concluded that the Tobago snake was a subspecies of *Erythrolamprus aesculapii*, thus *Erythrolamprus aesculapii ocellatus* (Peters, 1868).

Recent workers have followed Emsley (1966a) in recognizing a single species and two subspecies of *Erythrolamprus* on Trinidad and Tobago (*Erythrolamprus aesculapii aesculapii* on Trinidad, and *E. aesculapii ocellatus* on Tobago).

We present evidence below to establish the occurrence of two species of *Erythrolamprus* on Trinidad (*E. aesculapii* and *E. bizona*) and to show that the *Erythrolamprus* of Tobago is a valid species, *Erythrolamprus ocellatus.*

Species accounts

Erythrolamprus bizona Jan, 1863

Erythrolamprus aesculapii: - Schmidt, K. P., 1957:Fig.9; Underwood, G., 1962:179; Emsley, M. G., 1963:576-7, 1966a:129; Mertens, R., 1972:4; Greenhall, P., 1977:43; Boos, H., 1984:5, 1987:5.

Erythrolamprus aesoulapii: - Wehekind, L., 1960a:4, 1960b:4, 1960c:73.

Erythrolamprus aesculapii subsp. inc.: - Mertens, R., 1973:162.

Erythrolamprus aesculapii aesculapii: - Boos, H., 1975:25; Emsley, M., 1977:246.

Erythrolamprus [sp.]: - Hardy, J. D., Jr., 1982:86.

Erythrolamprus aesculapii ocellatus: - Mehrtens, J. M., 1987:222; Mueller, P., 1973:70 (possible occurrence on Trinidad and/or Tobago implied); Peters, J. A., and B. Orejas-Miranda, 1970:111.

There has been a great deal of confusion regarding the specimen (or specimens) of *Erythrolamprus* formerly in the collection of the Royal Victoria Institute Museum, Port of Spain, Trinidad. In 1979 we examined a single *Erythrolamprus* at the Institute. The attached label stated that it was collected at Diego Martin, Trinidad, on 10 Nov. 1941. A separate slip of paper indicated that it was identified by Karl P. Schmidt.

Following his 1963 paper, Emsley again referred to the "single specimen of *E. aesculapii* known from Trinidad, which is in the Royal Victoria Institute labeled 'Diego Martin 10.xi.1961'" (note the difference in date: 1961, not 1941). He gave ventral and subcaudal counts for this specimen as 180 and 43 (Emsley, 1966a).

Mertens (1973) examined what we assume to be the same specimen and stated the data as "Diego *Martini* [italics are ours], Trinidad, Museum Port of Spain (R.V.I.M. 112, l. 10. 11. 41.)". He presented ventral and caudal counts ("189+1/1, 57,58 + ?") which differed remarkably from those reported by Emsley (1966a). Our ventral and subcaudal counts, taken in 1979, agree with those of Mertens (189; 57, 58).

We are convinced that the photograph presented by Mertens (1973) is of the same specimen used to illustrate Schmidt's earlier paper (Schmidt, 1957). In Schmidt's illustration the specimen appears to have been pinned, while in the Mertens photograph it was not (thus accounting for the difference in the shape of the body as presented in the two illustrations). The number of body rings is the same in both pictures, and the string holding the specimen tag is in the same position in both. We are also convinced that all of these observations refer to a single specimen (R.V.I.M. 112) in spite of differences in the data presented by Emsley (1966a), and Mertens (1973).

A distinct nuchal band is evident in the photographs of the Royal Victoria Institute specimen presented by Schmidt (1957) and Mertens (1973) as well as in photographs taken by us in 1979 (Fig. 2). Additionally, the subcaudal count (57, 58) falls well above the highest subcaudal count reported both from the literature and our own recent counts for E. *aesculapii* (53). The combination of these two characters (a nuchal band and high subcaudal count) clearly identifies this specimen as *Erythrolamprus bizona*.

During the last five years the Royal Victoria Institute has undergone considerable renovation. When this work began, the reptile collection was put in temporary, off-site storage, with the unfortunate result that the specimen of *Erythrolamprus bizona* now appears to be lost. We feel, however, that the various photographs and comments cited above plus our own research are sufficient to establish the fact that *E. bizona* occurs (or once occurred) on the Island of Trinidad.

Erythrolamprus bizona is a black-, red-, and yellow-banded snake. The color pattern of the head is variable (Fig. 1). The snout may be light or dark, and the post-ocular pale band may be broad and conspicuous or reduced to a few light spots on or near the inner edges of the parietals. No subspecies are recognized.

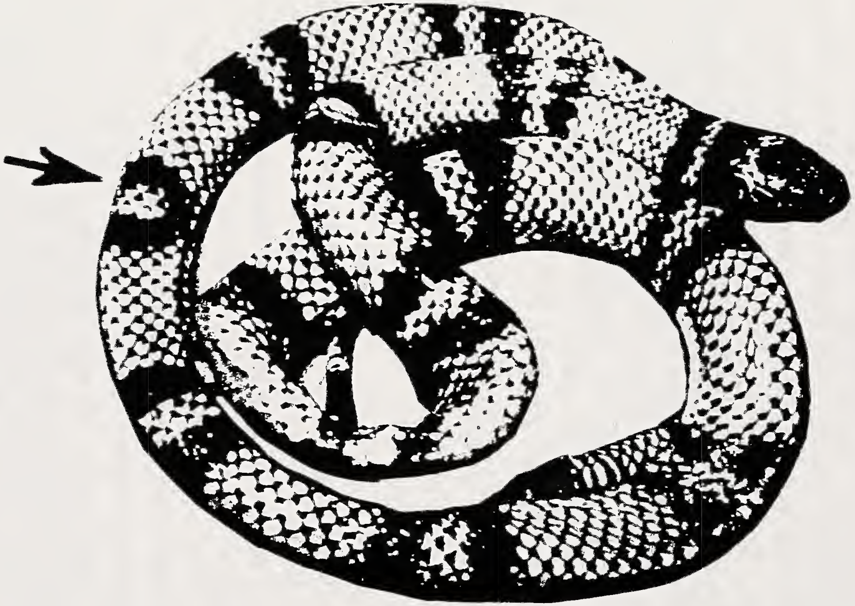

Fig. 2. *Erythrolamprus bizona*. RVIM 112, Diego Martin, Trinidad. Arow indicates an incomplete pair of body rings (see also Fig. 10a.). The nuchal band is well-developed.

Erythrolamprus bizona can apparently reach a maximum length of 1000 to 1500 mm (Lancini, 1979; Lancini and Kornacker, 1989; Perez-Santos and Moreno, 1988). The largest specimen which we examined was approximately 895 mm in total length.

Nothing is known of the life history and ecology of *Erythrolamprus bizona* in Trinidad. Boos (1984, 1987) states, in fact, that the single specimen of this species [which he called *E. aesculapii*] may be a stray from Venezuela (a circumstance which we now regard as unlikely). Mehrtens (1987) states that this species is terrestrial and secretive and that it emerges "after dusk to forage for small snakes, lizards, and small mammals". Swanson (1945) working in Panama, recorded the boa constrictor, *Constrictor constrictor*, in the diet of this species. Dunn (1933, 1954) described an encounter between a captive *E. bizona* and a specimen of *Pliocerus euryzonus dimidiatus* in which the latter was apparently killed by the bite of the former. Roze (1966) recorded *E. bizona* at altitudes of 400 to 2000 meters in Venezuela, while Scott (1969) recorded it from sea level to 1450 meters in Costa Rica; and Perez-Santos (1986) and Perez-Santos and Moreno (1988) observed a maximum altitude of 2500 to 2700 meters in Colombia. *Erythrolamprus bizona* is oviparous, depositing its eggs in rotten logs or decomposed litter. Hatchlings are 6 to 8 inches long (Mehrtens, 1987). Gutierrez, Solorzano, and Cerdas (1984) reported a diploid chromosome number of 28.

Erythrolamprus aesculapii (Linnaeus, 1766)

We have examined a single specimen of this species (AMNH 75746) which was collected by James A. Oliver on the ridge above St. Pat's Estate, Arima Valley, Trinidad. There are 198 ventrals and 41 subcaudals. There is no nuchal band.

Like *Erythrolamprus bizona, E. aesculapii* is typically a red-, yellow- and black-banded snake. The snout is usually pale, sometimes conspicuously so. The post-ocular pale band may be broad and conspicuous or greatly reduced. It is typically uniform in color, but may be marked by various patterns of dark pigment. In the specimens which we examined, there is always at least some light pigment on or near the suture separating the parietals (Fig. 3). Four subspecies are recognized (excluding *Erythrolamprus aesculapii ocellatus*). These subspecies are differentiated primarily on the basis of shape and spacing of the body rings. We associate the Trinidad specimen with the nominate subspecies, *E. aesculapii aesculapii*.

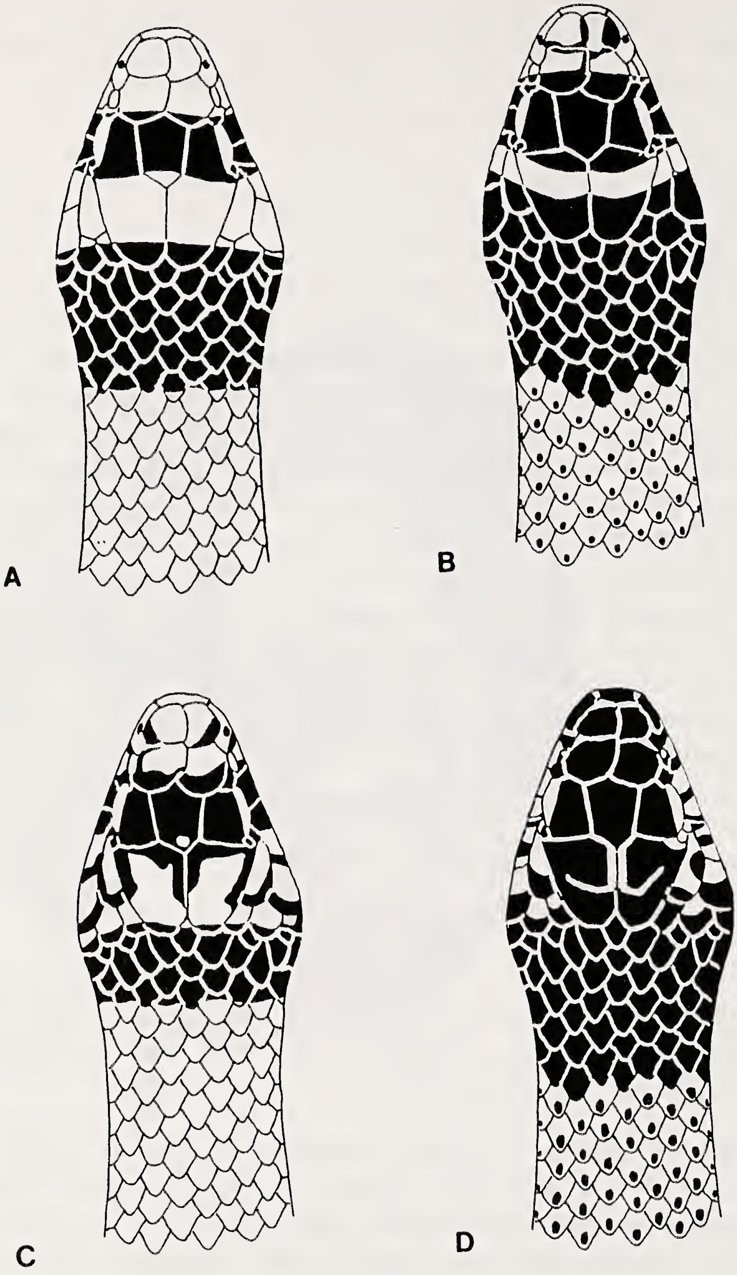

Fig. 3. *Erythrolamprus aesculapii*. Variations in head pattern. A. USNM 64632, Surinam. This is the typical pattern for this species. B. USNM 158097, Brazil. C. USNM 11320, Brazil. D. USNM 165560, Brazil (subspecies *E. aesculapii venustissimus*). The specimens represented in figures A and C lack scale-tip pigment anteriorly, but this may be an artifact of preservation.

The maximum length of *Erythrolamprus aesculapii* is probably somewhere between 1000 and 1500 mm (Perez-Santos and Moreno, 1988; Briceno Rossi, 1934). The largest specimen we examined was approximately 1015 mm long.

Nothing is known of the life history or ecology of *Erythrolamprus aesculapii* in Trinidad. Dixon and Soini (1977, 1986), working in the Peruvian Amazon, felt that it was restricted to closed-canopy forest, and observed specimens in leaf litter or, sometimes, crossing paths. Sazima and Abe (1991), in their Brazilian study, observed specimens in disturbed and cultivated areas as well as in the forest. Abuys (1983), writing of the genus as it occurs in Surinam, described the habitat as "savannah-forest stream areas of the Amazon and Guyanas". Hoogmoed (1979) recorded it at elevations of 0 to 240 meters in the Guianan region, while Perez-Santos and Moreno (1991a, 1991b), working in Ecuador, give a maximum elevation of 1200 meters. Mertens (1955) briefly described mating in *E. aesculapii* but gave no date or season. Amaral (1984) states that, in Brazil, *E. aesculapii* lays six to nine "semi-elliptical eggs". Hatchlings have been observed in December in Peru (Dixon and Soini, 1977, 1986). As with E. *bizona,* the diploid chromosome number is 28 (Becak and Becak, 1969; Benirschke et al, 1975).

Amaral (1984) points out that *Erythrolamprus aesculapii* is omnicarnivorus, feeding on "rats, lizards, frogs, and other small animals". Specific food items include crickets, *Synbranchus* (an eel-like freshwater fish), lizards (*Mabuya, Placosoma,* and *Tropidurus*), and the following snakes: *Atractus* sp., *Atractus trilineatus, Dipsas incerta, Dipsas* sp., *Echinantera affinis, Echinantera occiptalis, Echinantera perssimilis, Echinantera undulata, Leptodeira annulata, Liophis cobella, Liophis miliaris, Liophis poecilogyrus, Liophis* sp., *Liophis typhlus, Micrurus* sp., *Ninia atracta, Oxyrhopus guibei, Oxyrhopus petola, Sibynomorphus neuwiedi, Tantilla longifrontalis, Tantilla melanocephala, Thamnodynastes* sp., and *Xenodon sererus* (Beebe, 1946; Bertono, 1914; Cunha and Nascimento, 1978; Greene, 1976; Marques and Puorto, 1994; Sazima and Abe, 1991). Phillips (1962) described and encounter between *Erythrolamprus aesculapii* and a coral snake, *Micrurus frontalis,* in which both animals died, apparently of poisoning. Predators may include the hawk, *Buteo magnirostris* (see Sazima and Abe, 1991).

The nematode worm '*Kalicephalus costatus costatus*' has been recorded from "*Erythrolamprus venustissimus*" (herein regarded as a subspecies of *E. aesculapii*), and another nematode, *Cruzia rudolphi,* has been recorded from *Erythrolamprus aesculapii aesculapii* (see Vincente, Rodrigues, Gomes, and Pinto, 1993). Artigas and Paulino (1988) have recently described a new trematode, *Zeferinella vazin,* from the buccal cavity and esophagus of *E. aesculapii.*

Erythrolamprus ocellatus Peters, 1868

Erythrolamprus ocellatus: - Peters, W., 1868:642 (type locality not stated, determined by Emsley, 1966a); Underwood, G., 1962:169; Hardy, J. D., Jr., 1982:86.

Erythrolamprus "ocellatus": - Mertens, R., 1956:Fig. 37 (photograph of the type specimen, locality not given).

Erythrolamprus occellatus: - De Verteuil, J. P., 1963:101, 1968:101.

Erythrolamprus aesculapii ocellatus: - Emsley, M. G., 1966a:128-9, 1966b:663-4, 1977:247; Mertens, R., 1969:67, 1972:13, 1973:161; Mueller, P., 1973:70 (occurrence on Trinidad and/or Tobago implied); Boos, H., 1984:5, 1987:5; Peters, J. A., and B. Orejas-Miranda, 1970:111; Krintler, K., 1982:13; Mehrtens, J. M., 1987:222.

Erythrolamprus aesculapii (*ocellatus*): - Boos, H., 1975:25.

Erythrolamprus aesculapii: - Greenhall, P., 1977:43; Obst, F., *et al.*, 1984:160; Coborn, J., 1991:382.

Erythrolamprus aesculapii aesculapii: - Perez-Santos, C. E., 1986:372; Perez-Santos, C., and A. G. Moreno, 1991b:180.

Unlike all other members of the genus *Erythrolamprus, E. ocellatus* typically lacks black rings anterior to the anus. The pattern consists instead of 22 to 30 large, black, dorsal ocelli. There is usually a small amount of white pigment in the center of each ocellus, or each ocellus is marked with a narrow, transverse band of white (Fig. 4). In adult specimens of *E. ocellatus* the dorsal surface of the head is either black throughout, or there are a few small, white, lateral blotches. This white coloration rarely reaches the outer edges of the parietals (Fig. 5.)

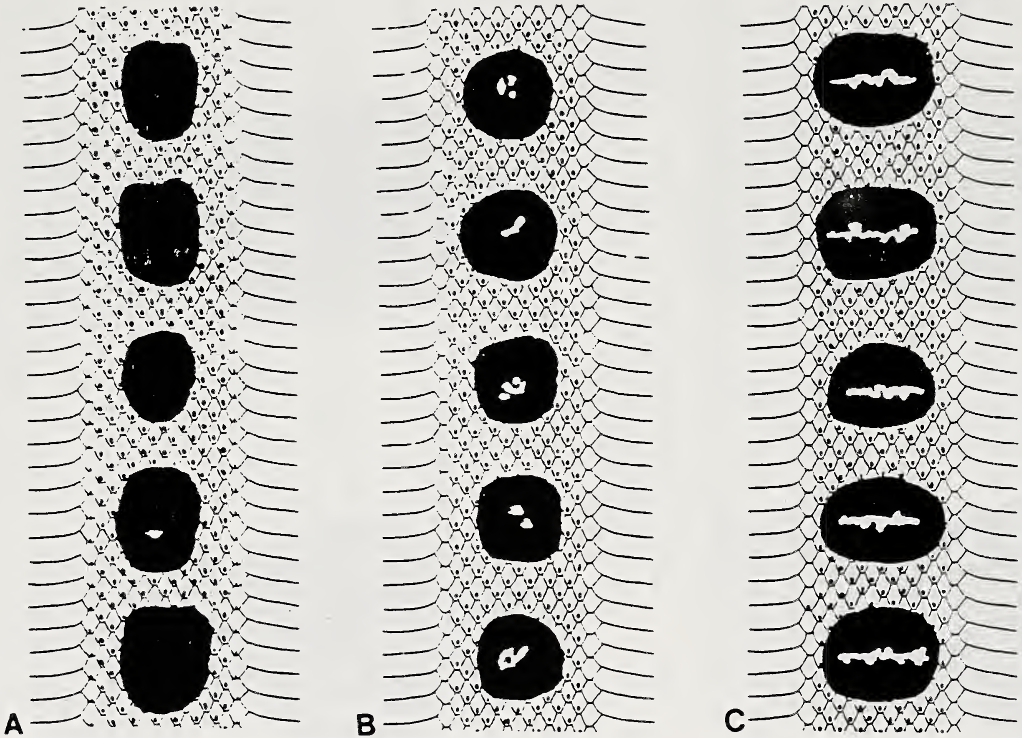

Fig. 4. *Erythrolamprus ocellatus*. Variation in dorsal pattern. A. USNM 228056, St. John Parish, Tobago. Most ocelli in this specimen are without light centers. B. USNM 228055, St. John Parish, Tobago. Light pigment is limited to the center of each ocellus. This is the typical pattern. C. USNM 228050, St. Paul Parish, Tobago. Light pigment is extended transversly forming distinct bars.

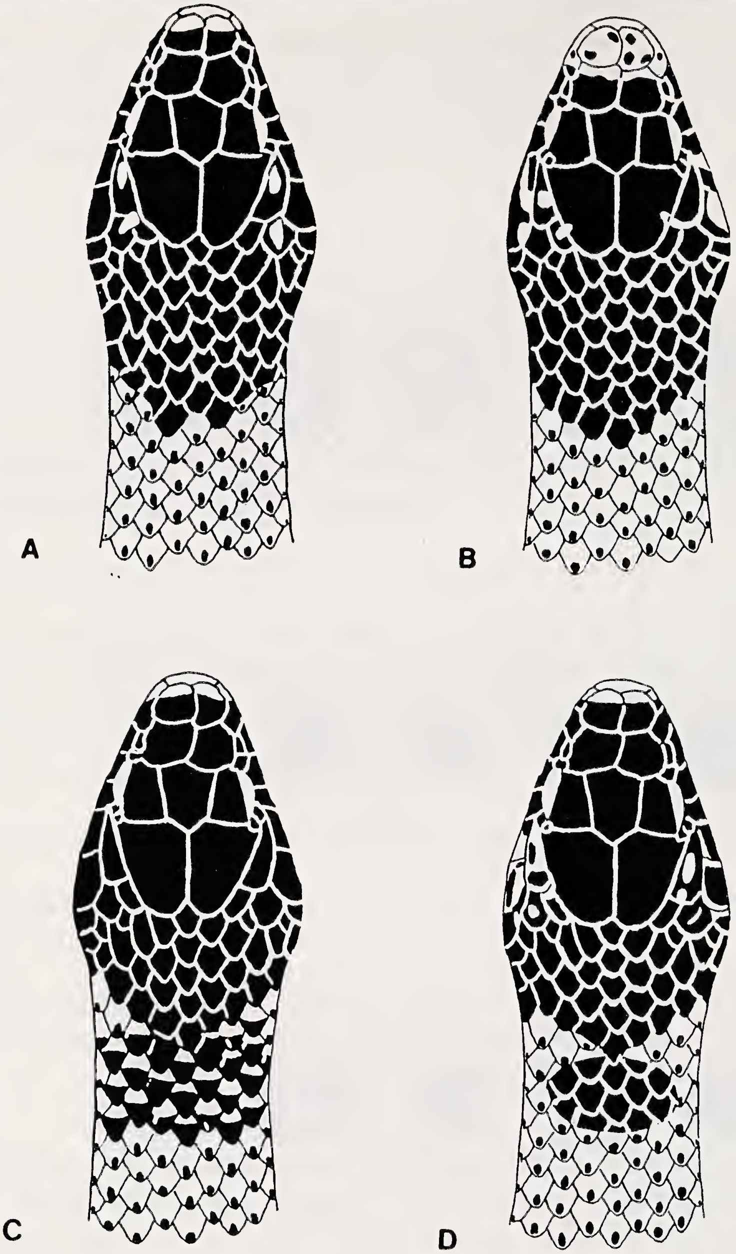

Fig. 5. *Erythrolamprus ocellatus*. Variation in head pattern. A. USNM 228053, St. John Parish, Tobago. Typical pattern. B. USNM 228058, St. George Parish, Tobago. Note the slight encroachment of white pigment on the outer edges of the parietals. C. USNM 325088, St. John Parish, Tobago. The indication of a nuchal band is an unusual pattern modification. D. USNM 228056, St. John Parish, Tobago. The "nuchal band" is consolidated into a single blotch.

We have examined a single juvenile ca. 188 mm long. In this specimen, which we presumed to be a recent hatchling, the snout was red and there was a broad white area on each side of the head just behind the eyes. These white markings were connected mid-dorsally by diffuse red pigment to form a distinct post-ocular band (Fig. 6) Except for the red pigment, these markings are more-or-less comparable to the pigment pattern seen in many adult specimens of *Erythrolamprus aesculapii* (Fig. 3).

As with the dorsal ocelli, the ventral pigment of *Erythrolamprus ocellatus* is also unique within the genus. Bright red pigment extends on to the outer edges of the ventrals along most of the length of the body. Mid-ventrally there is a broad, ragged-edged, more-or-less continuous white band extending from the neck to the tail (Fig. 7). The undersurfaces of the head and neck are white.

Peters (1868) commented that the type specimen of *Erythrolamprus ocellatus* was "mit einem schwarzen Nackenbande". A suggestion of a neck band is evident in the photograph of the type specimen presented by Mertens (1956). In some of the specimens which we have examined there is an increase in scale-tip pigment on the neck which gives the impression of a broad saddle (Fig. 5c). In one specimen there is a small, solid blotch of black pigment on the neck which is narrowly confluent with the dorsal head pigment (Fig. 5d).

Erythrolamprus ocellatus is a smaller snake than either *E. aesculapii* of *E. bizona.* de Verteuil (1963, 1968) records a maximum length of "2 feet" for *Erythrolamprus ocellatus.* The largest specimen which we examined was approximately 545 mm long.

Marques and Puorto (1994) found that specimens of *E. aesculapii* less than 350 mm long were immature, while specimens longer than 350 mm were mature. Since both *E. aesculapii* and *E. bizona* reach a maximum length of 1000 to 1500 mm, we assume that these two species probably become mature at about the same size (ca. 350 mm). Based upon this assumption "juveniles" of both *E. aesculapii* and *E. bizona* have been excluded from our comparisons. The length at maturity of *E. ocellatus* is unknown. Our data therefore include all specimens in the USNM collection except a single obvious juvenile 188 mm long (USNM 325086). On the basis of these comparisons, the differences in mean length between *E. ocellatus* and *E. aesculapii* and between E. *ocellatus* and *E. bizona* are statistically significant at the .05 level of significance (Fig. 8).

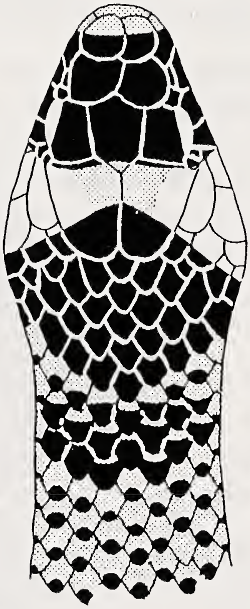

Fig. 6. *Erythrolamprus ocellatus*. USNM 325086, St. Paul Parish, Tobago. Juvenile, 188 mm total length. Stippling indicates red pigment. (Comapre to Fig. 3a).

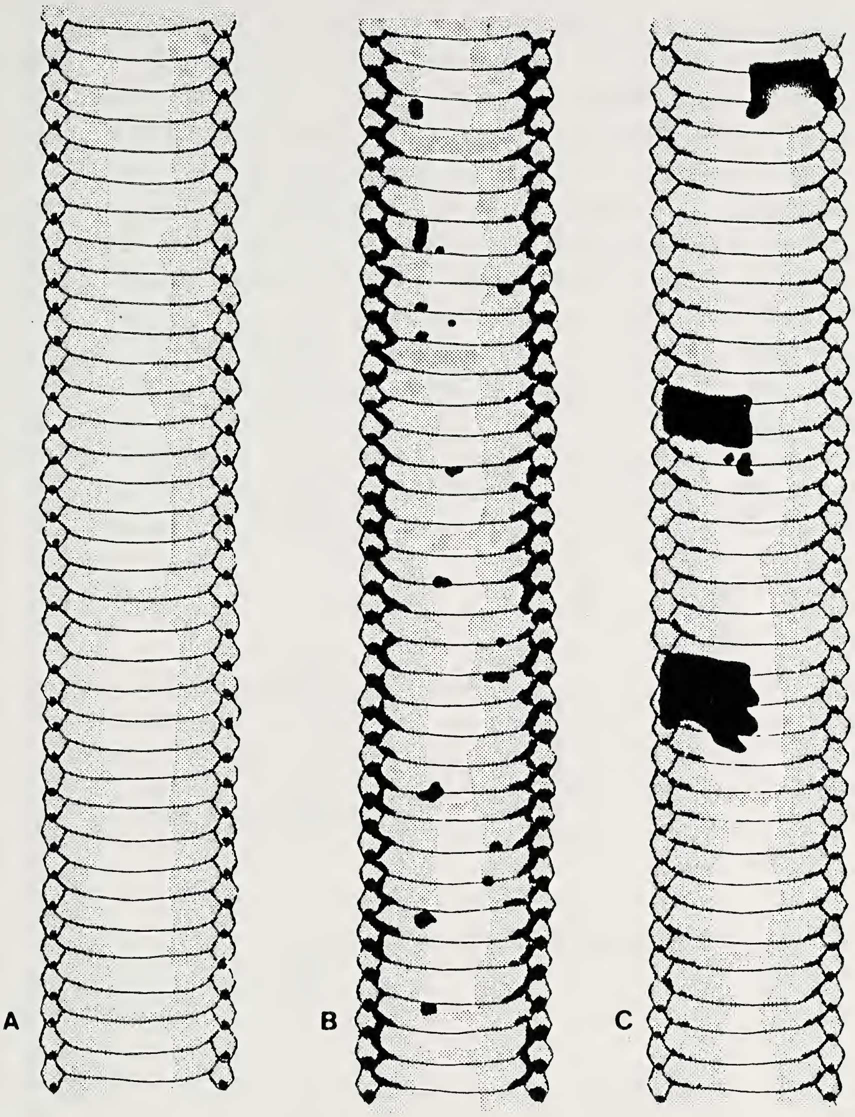

Fig. 7. *Erythrolamprus ocellatus*. Variation in ventral pigment. A. Typical pattern (composite drawing). B. USNM 325088, St. John Parish, Tobago. Small, black punctations are scattered along the belly. C. USNM 325087, St. John Parish, Tobago. The three large ventral blotches end on the first scale row and alternate with the dorsal ocelli. Stippling represents red pigment.

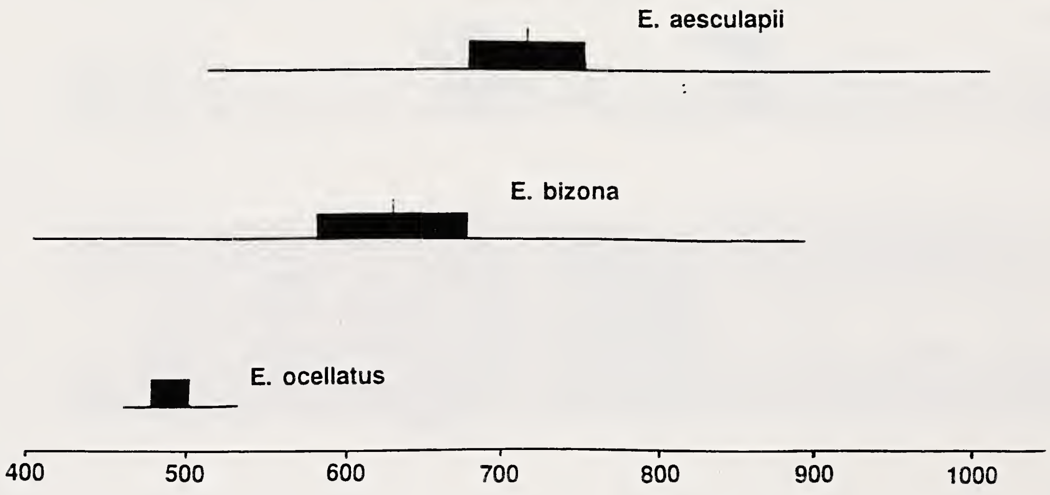

Fig. 8. Comparison of total length. *Erythrolamprus aesculapii*: n = 31, range = 515-1015 mm, mean = 719.06 mm, SE = 18.97. *E. bizona*: n + 25, range = 404-895 mm, mean = 632.04 mm, SE = 24.98. *E. ocellatus*: n = 12, range = 471-545 mm, mean = 501.83 mm, SE = 6.80. The heavy bar represents two standard errors on each side of the mean.

As noted in the introduction, we have correlated our meristic data (ventral and subcaudal counts) with the presence (" *E. bizona*") or absence (" *E. aesculapii*") of a nuchal band. Our data, based on this combination of characters, differs remarkably from published data (Table 1). Specifically, we found very low subcaudal counts in specimens with a nuchal band (" *E. bizona*"); and no specimens of "*E. aesculapii*" (nuchal band lacking) with ventral counts of less than 183. Our assumption regarding the presence or absence of a nuchal band may, of course, be in error. On the other hand the low ventral counts for *E. aesculapii* presented in the literature (minimum 170) may reflect recent changes in the status of various species and subspecies of *Erythrolamprus*. *Erythrolamprus baileyi* and *Erythrolamprus baupartisima* (both low-ventral count species) have recently been placed in the synonymy of *E. aesculapii* (the former synonomy has been widely accepted, but Campbell and Lamar (1989) appear to question the latter). Some authors, among them Vincente, Rodrigues, Gomes, and Pinto (1993) regard *Erythrolamprus aesculapii venustissimus* as a valid species, *E. venustissimus*.

Table 1. *Erythrolamprus*. Meristic data taken from literature sources and from our own research. Bold numbers indicate major differences between these two sources of data. 1. Lancini, 1979; Lancini and Kornacer, 1989. 2. Dumeril and Bibron, 1854 (as *Erthrolamprus venustissimus*). 3. Taylor, 1954. 4. Emsley, 1966.

	Sub-caudals	Ventrals
Literature sources:		
E. aesculapii	31[1]-53[2]	**170**[1]-204[2]
E. bizona	**47**[3]-62[1]	180-204[1]
E. ocellatus	40-49[4]	173-183[4]
Present research:		
E. aesculapii (no nuchal band)	34-50	**183**-201
E. bizona (nuchal band)	**39**-60	178-200
E. ocellatus	41-46	173-179

Using our own data (exclusively) we find statistically significant differences in ventral scale counts between *Erythrolamprus ocellatus* and *E. bizona*, and between *Erythrolamprus ocellatus* and *E. aesculapii* at the .05 level of significance (Fig. 9). Published ventral counts for *Erythrolamprus ocellatus* (173-183) show little overlap with published counts for *E. bizona* (180-204), but statistical tests can not be made from these data.

Emsley compared his Tobago material to the single specimen of *Erythrolamprus* in the collection of the Royal Victoria Institute Museum (Emsley, 1966). His subcaudal and ventral counts (43, 180) for the RVIM specimen (identified in this paper as *Erythrolamprus bizona*) fell within his range of values for *E. ocellatus* (40-49, 173-183). In further comments on the Trinidad specimen (which he erroneously identified as *Erythrolampus aesculapii*) Emsley noted that there was a "retreat of the black annulations from the belly" in one of the pairs of trunk annuli on the Trinidad snake. His conclusion that the Tobago snake was a subspecies of *E. aesculapii* (*Erythrolamprus aesculapii ocellatus*) was presumably based on these observations.

As pointed out above, Emsley's subcaudal and ventral counts for the Trinidad specimen (now recognized as *Erythrolamprus bizona*) were in error (the correct counts are 189 and 57/58). In addition, the presence of an incomplete pair of annuli in the Trinidad specimen of *E. bizona* does not imply a subspecific relationship to *Erythrolamprus ocellatus*. Semi-ocelli (pairs of bands that reach the venter only on one side and are rounded on the other) are a fairly common feature in specimens of *E. bizona* throughout its range (Fig. 10a). Savage and Slowinski, 1992) observed saddles ("saddle-shaped blotches extending only a short distance onto [the] flanks") in *Erythrolamprus aesculapii*; and we have observed similar markings, some of which are almost identical to the ocelli seen in *E. ocellatus*, in *E. aesculapii* (Fig. 10b).

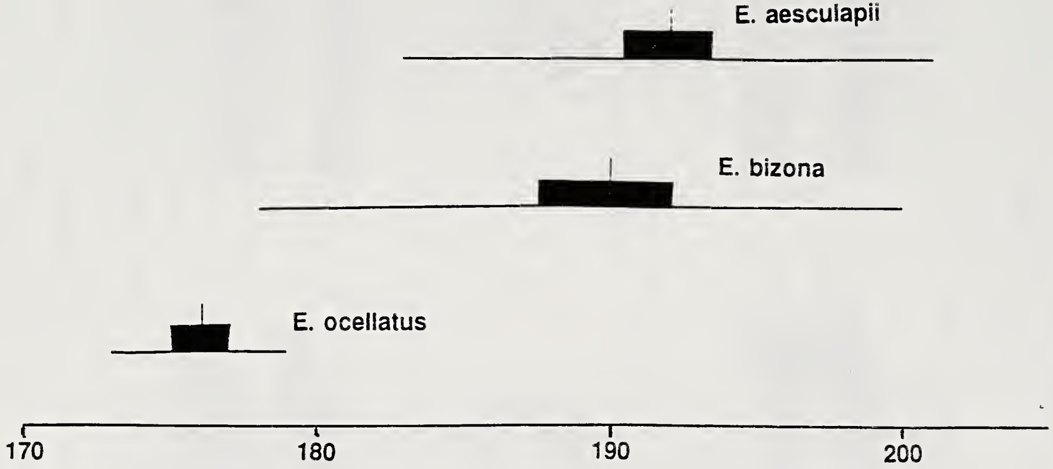

Fig. 9. Comparison of ventral scale counts. *Erythrolamprus aesculapii*: n = 44, range = 183-201, mean = 192.05, SE = 0.75. *E. bizona*: n = 34, range = 178-200, mean = 189.10, SE = 1.08. *E. ocellatus*: n = 13, range = 173-179, mean = 176.08, SE = 0.56. The heavy bar indicates two standard errors on each side of the mean.

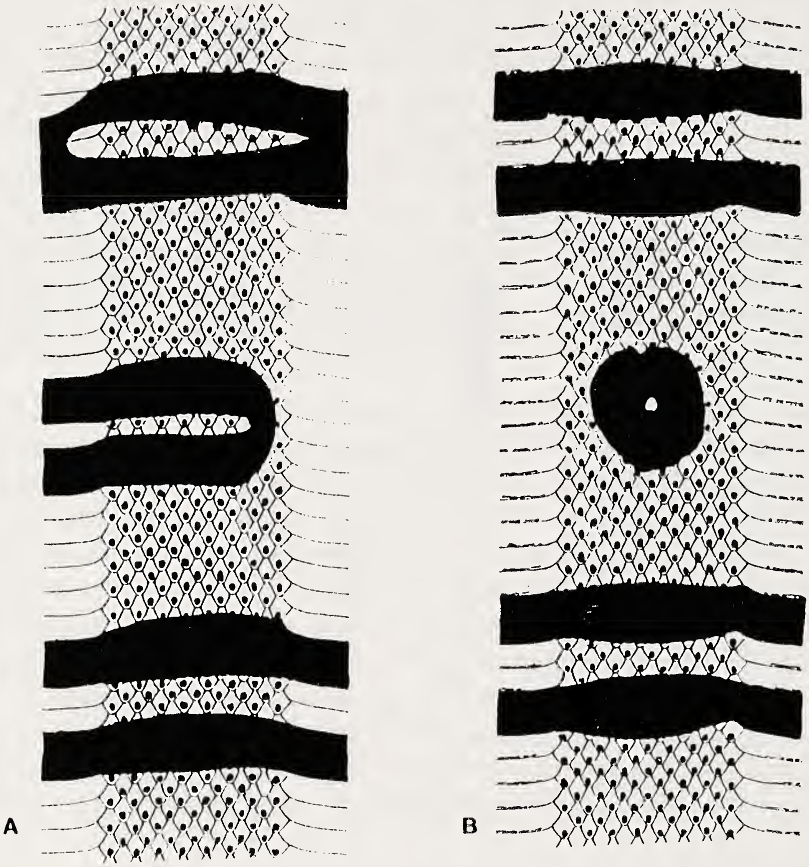

Fig. 10. Atypical dorsal patterns in Central and South American populations. A. *Erythrolamprus bizona*. USNM 37480, Costa Rica. One pair of bands is fused ventrally, another forms a semi-ocellus (see also Fig. 2). B. *E. aesculapii*. USNM 12412, Paraguay. The single dorsal ocellus is similar to the ocelli seen in *E. ocellatus* (see Fig. 4).

We regard *Erythrolamprus ocellatus* as a distinct species for the following reasons:

1. The dorsal pattern of black ocelli is unique within the genus.
2. The presence of a more-or-less continuous mid-ventral band of white is unique within the genus.
3. The dorsal surface of the head of adults is typically black throughout.
4. Ventral scale counts for *Erythrolamprus ocellatus* appear to be significantly lower than ventral counts for *E. bizona* (including data from all sources). Based exclusively on our own recent counts *E. ocellatus* also has significantly fewer ventral scales than *E. aesculapii.*
5. Erythrolamprus ocellatus is a much smaller snake than either *E. aesculapii* and *E. bizona.*
6. The presence of an odd pair of bands in the only known specimen of *E. bizona* from Trinidad is a pattern variation seen throughout the range of that species and does not imply a subspecific relationship to *E. ocellatus* (similar pattern variations are also seen in *E. aesculapii*).
7. *Erythrolamprus ocellatus* is geographically isolated from all other species of *Erythrolamprus.*

Little is known of the life history of *Erythrolamprus ocellatus.* All of the specimens in the collection of the USNM were found dead on the road or were killed by local collectors. Most road kills are found between sunrise and 12:00 A.M. One local man claimed that "red snakes" were abundant just after dawn in a ravine behind his house. He brought us a freshly-killed specimen (at breakfast time) to prove his point! One of us found a living specimen crossing a road near Hillsborough Dam at approximately 11:00 A.M. de Verteuil (1963, 1968) stated that *E. ocellatus* "is confined to high forested country". Some of our road kills have come from sea level, but only in areas where the mountain slopes come down to the sea. Boos (1984, 1987) reports this species from leaf litter in forested areas. Bird watching groups have reporting seeing living specimens along trails in forested areas during the morning hours. According to local reports it occurs in agricultural areas as well as forests, and some of the road kills have been taken in close proximity to open fields.

The only specimen we have seen alive (mentioned above) ate a gecko (*Hemidactylus mabouia*). A road-killed specimen (too badly damaged to preserve) had eaten a *Tantilla melanocephala*. A specimen of *Atractus trilineatus* was found in the gut of one of the USNM specimens (USNM 228052).

Acanthocephalans were found in the axial musculature and nematodes were found in the connective tissue of the gut cavity of USNM 228050. Neither of these parasites has been specifically identified.

Nothing is known of the reproductive habits of *Erythrolamprus ocellatus*. A juvenile 188 mm in total length, and perhaps recently-hatched, was found crossing a dirt road at Merchiston Estate on 1 November 1992. The chromosome number is unknown.

Acknowledgments

This paper is part of an on-going study of the zoology of Tobago. This study has been supported by funds from the American Philosophical Society, The Organization of American States, Earthwatch, and the Tobago House of Assembly. We are grateful for that financial assistance. We wish to thank Dr. Roy McDiarmid, of the National Biological Service, for his many useful suggestions; and the staff of the Division of Amphibians and Reptiles, United States National Museum of Natural History, for allowing us to examine specimens in the collection under their care. Dr. Joseph Bailey, of the Department of Zoology, Duke University, North Carolina, made many useful suggestions during the early stages of the development of this project. The senior author wishes to thank his wife, June, for her assistance, encouragement, and support during the final, frantic days of the preparation of this manuscript. He also wishes to thank Mr. and Mrs. Charles Turpin, of Charlotteville, Tobago, for their many kindnesses shown to him and his associates during their visits to Tobago.

Specimens Examined

Erythrolamprus aesculapii:

BRAZIL: USNM 7362, "Rio Janeiro", June, 1968; USNM 11273, Rio Medeira, July, 1878; USNM 11320, Amazonas-Rondonia, Rio Madeira, June, 1878; USNM 38188, Sao Paulo, Instituto Butantan, no date; USNM 39069, Estacao Rio Grande (=Ribeirao Grande de Serra), no date; USNM 69246, Sao Paulo, no date; USNM 76373-6, Estado do Sao Paulo, no date; USNM 98651, Rio de Janeiro, Theresopolis, Guapi, April, 1935; USNM 100675, Sao Paulo Estado, Sao Paulo 10 April 1935; USNM 100687, Sao Paulo, Alvares Machado, 8 April 1935; USNM 100694, Sao Paulo, Garca, 15 April 1935; USNM 149131, Para, Belem, Instituto Agronomico do Norte, 18 Feb. 1963; USNM 158096-7, Para, Belem, Utinga, near Lago Agua Preta, 1965 (2 specimens); USNM 165556, Sao Paulo, Assis, 20 Feb. 1867; USNM 165557, Sao Paulo, Fernandopolis, 22 Feb. 1967; USNM 165558, Sao Paulo, Sao Jose Potuvera (=Botuvera?), km. 42 BR Rodovia, 17 April 1967; USNM 165559, Sao Paulo, Borore, Repressa Billings, Santo Amaro District, 23 Feb. 1967; USNM 165560, Sao Paulo, Agudos, 8 March 1967; USNM 219070, Rio de Janeiro State, Itaipava, vicinity of, ca. 15 km. NNE of Petropolis, 6 Feb. 1955. **BOLIVIA**: USNM 280763, Beni, Ballivian, Rurrenabaque, 260 m, 9 m August 1979. **ECUADOR**: USNM 210977, Norona-Santiago Prov., Macuma, May, 1953; USNM 210978, Napo Prov., Suno, Distrito del, Alto Rio Napo, April, 1951; USNM 210979, Pastaza Prov., Rio Bobonaza, Cabeceras del, June, 1965; USNM 210980, Pastaza Prov., Rio Capahuari, mouth of, May, 1960; USNM 210981, Pastaza Prov., Sarayacu, March, 1941; USNM 210982, Pastaza Prov., Alto Rio Curaray, March, 1956; USNM 210983, Pastaza Prov., Rio Villano, Sept., 1954; USNM 210984, Pastaza Prov., Curaray, Army Base, Dec., 1963; USNM 321113, Pastaza, Coco, 130 km. S of, Nuevo Golandrina, on trail W toward Rio Curaray, 300 m., 1 Sept. 1990. GUYANA: USNM 462, "Guyana", no date; USNM 55960, Demerara, 1902; USNM 84528, Pomeroon, Aug-Sept., 1931. **PARAGUAY**: USNM 5862, "Paraguay", no date; USNM 12412, "Paraguay, no date; USNM 142095, Capital Dist., Asuncion, June, 1959. **SURINAM**: USNM 64632, Marowijne Dist., Moengo, no date; USNM 234021, Nickerie, Sipaliwini, no date (skin and skeleton); USNM 321582, Nickerie, Sipaliwini, Kwamalsemutu, 31 May 1990. **TRINIDAD**: AMNH 75746, ridge above St. Pat's Estate, Arima Valley. **PERU**: USNM 60728, Cuzco, Rio Cosireni, 3000 ft., August, 1915; USNM 193810, Departamento

Huanuco, Castillo across Rio Huallaga from Tingo Maria, 670 m., 19 June 1968; USNM 222354, Puerto Maldonado, 30 km (airline) SSW of, south bank of Rio Tambopata, east of Rio LaTorre (= Rio D'Orbigny), 280m, 18 Nov. 1979; USNM 247503, Puerto Maldonado, ca, 30 km. (straight line) SSW of, Tambopata Reserve, Explorer's Inn, near Laguna Coco Cocha, between March and May, 1984.

Erythrolamprus bizona:

COLOMBIA: USNM 37030, Atlantico, Puerto Colombia, 10 April 1906; USNM 115108, Guajiro, Nazaret, 27 April 1941; USNM 151734, Valle, Cali area, near hospital, 1 November 1962; USNM 151735, Valle, Gorgona area, N. of Cali, 27 Nov. 1962; USNM 151740, Valle, ranch near Yumbo, 12 April 1962; USNM 154033, Valle, Buenaventura, July, 1963; USNM 195910, Meta Intendencia, Villavicencio, Rio Guatiquia de Alvarado, Graciela, 17 April 1972; USNM 195911, Meta Intendencia, Villavicencio, Barrio Esperanza 10 August 1971; USNM 195913, Meta Intendencia, Villavicencio, 13 December 1971; USNM 195914, Meta Intendencia, Villavicencio, 5 Feb. 1971; USNM 195915, Meta Intendencia, Apiay (Air Force Base), 12 km SE of Villavicencio, in direction of Puerto Lopez, 18 May 1971; USNM 195916, Meta Intendencia, San Martin, 7 Oct. 1971; USNM 195917, Meta Intendencia, Villavicencia, 16 July 1971; USNM 195918, Meta Intendencia, Villavicencia, 8 Nov. 1970; USNM 195919, Meta Intendencia, Villavicencia, 4 Feb. 1970. **COSTA RICA**: USNM 6355, "Arriba" (this may not be a real locality, see Dunn and Stuart, 1951); USNM 9779, 9781, 9784 "Costa Rica", 1878; USNM 13536, "San Jose", 31 July 1883; USNM 14013, "Costa Rica, 3 Nov. 1884; USNM 30677©8, "Costa Rica", no date; USNM 37480, "San Jose", 1160 m., 20 April 1906; USNM 70664, Guanacaste, Tilaran, no date; USNM 148015, Guanacaste, 2 mi S Las Canas, 300 feet, 23 Feb. 1963. **PANAMA**: USNM 51916, Los Santos Prov., no date; USNM 52490, "Panama", Sept. 1914; USNM 54008, Panama, 1911-1912; USNM 65881, Canal Zone, 1921 (?); USNM 102728, Panama Prov. (?), near Juan Diaz, 28 Feb. 1937 (head and anterior part of body only); USNM 127305, Herrera Prov., Parita, Feb-March, 1948; USNM 129926, Panama Prov., Jagua, 4 Feb. 1951; USNM 140701, Canal Zone, near Fort Kobbe, 1958; USNM 257258, Barro Colorado Island, 20 Aug. 1979. **TRINIDAD**: RVIM 112, Deigo Martin, 10 Nov. 1941 (specimen lost). **VENEZUELA**: USNM 55334, Federal Dist., Caracas, no date. **NO DATA**: USNM 31283, no locality, no data.

Erythrolamprus ocellatus:

TOBAGO: USNM 195111, St. Paul Parish, intersection of Winward Rd. and Merchiston Rd., 4 Sept. 1972; USNM 228050, St. Paul Parish, near intersection of Windward Rd. and road to Merchiston, 10 May 1979 (skin and skeleton); USNM 228051, St. John Parish, ca. 1 mi S of Charlotteville on Windward Rd., 17 Dec. 1978; USNM 228052, St. John Parish, ca. 0.25 mi S of Charlotteville on Windward Rd., 19 July 1979; USNM 228053, St. John Parish, Charlotteville, 18 May 1979; USNM 228054, St. John Parish, ca. 0.5 mi SW of Speyside, 23 Dec. 1978; USNM 228055, St. John Parish, in forest above Speyside, 8 July 1979; USNM 228056, St. John Parish, Cambleton, 27 June 1979; USNM 228057, Charlotteville, 20 August 1979; USNM 228058, St. George Parish, ca. 1 mi from Hillsborough Dam on Easterfield Rd., 28 June 1979; USNM 313887, St. John Parish, Speyside, 20 March 1991; USNM 325086, St. Paul Parish, Merchsiton, 1 Nov. 1992; USNM 325087, St. John Parish, Charlotteville, top of mountain SE of junction of Lighthouse Rd. and Windward Rd., 5 Jan 1993; USNM 325088, St. John Parish, Charlotteville, junction of Windard Rd. and Northside Rd.

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ANNOUNCING THE MARYLAND HERPETOLOGICAL SURVEY

It's been almost twenty years since the Natural History Society of Maryland, Inc. published the last edition of the Distributional Survey (Amphia/Reptilia): Maryland and the District of Columbia by Herbert S. Harris, Jr. In that time three species have been added to the state's fauna, concepts of the local distribution of many species have changed, and concern has been expressed over the apparent reduction in numbers of various species. The NHSM is initiating a five year survey of Maryland's herpetofauna leading to preparation of a comprehensive publication (or publications) dealing with local herpetology. This survey will have several facets, as described below.

Distributional Data

Species distributions will be depicted with computer generated maps based on the U. S Geological Survey quad system. This will provide a reasonable degree of accuracy, easy update, and reliable documentation. Although the database will be maintained at a central location, county coordinators will be assigned to receive and review data for their area. When this project gets rolling, we anticipate that draft maps will be circulated on a regular basis to identify gaps where special attention should be directed. These maps can be coded to show historic vrs. current records.

As has been traditional with herpetological survey efforts, we welcome data associated with well preserved specimens deposited in a permanent collection. However, consistent with today's emphasis on observation as opposed to collection, we also consider sight records from reliable observers to be acceptable. Unusual occurrences or records for species that may be confused (i.e., "coastal plain milk snakes" and scarlet snakes, or new records for rainbow snakes) should be document photographically, and we encourage maximum use of cameras. The NHSM is establishing an archive for permanent storage of such slides and photographs.

Natural History

The North American literature contains a wealth of information about the natural history of the amphibians and reptiles that occur in Maryland. However, most of that information came from other areas and relatively little is specific to this state. For instance, can anyone precisely define the period during which gray treefrogs or narrowmouth toads call in Maryland? Conant and Collins, because they consider the entire range, give a period that s much too broad. Management of our local amphibian and reptile species requires that we know much more about their life histories than we do. Consequently, we are taking this opportunity to gather every bit of biological information that we can get on every resident species. Participants are encouraged to record and report all biological observations, even those that seem ordinary. A standardized record form will be provided for this purpose. The following list gives examples of the kinds of questions that we hope to answer.

> Have you observed changes in local distribution? Do you see species now that you did not see the past, or vise versa?
>
> When exactly do various species of frogs start and stop calling?
>
> What do our herps eat, and what eats them? What kind of aggressive encounters occur?
>
> When do they mate? When and where do they lay eggs, and how many? Do you note evidence of nest predation, and do you know what did it?
>
> What kind of parasites occur on/in wild caught herps?
>
> Where do our amphibians and reptiles hibernate (have you ever dug out a snake or frog in winter), and when do the enter and leave hibernating areas?

Long-term Population Monitoring

We also propose to coordinate a series of long-term studies at selected localities (one in each county would be ideal) to monitor numbers of reptiles and amphibians at specific locations. These surveys will be modeled after the one now being conducted at the Jug Bay Wetlands Sanctuary in Anne Arundel Count, and should detect and

document any changes that may be occurring in local populations. The role of the NHSM in this effort will be to help establish programs to provide even coverage, to ensure that comparable data is being collected in a standardized fashion, and to collect and evaluate data to formulate a state-wide picture. We can also serve as a clearinghouse for the dissemination of the data obtained to participants and other interested persons.

Another aspect of this survey will be an effort to gather personal observations of changes in abundance and distribution. We constantly hear naturalists lament that spotted salamanders no longer spawn in the pond in their woods or that a favorite copperhead den has been destroyed. Such information has been given little credibility because it is anecdotal, and no effort has been made to verify and quantify it so that it can be considered when management of amphibian or reptile populations is considered. We feel that such information is useful and will make every effort to compile it.

Accessibility of Data

Although our ultimate goal is publication of the data gathered, this will be an interactive association with relatively free access to information. We hope to find funding to computerize early-on. If so, we can generate regular hardcopy updates or open the files through the phone lines. However, security will be placed on sensitive information. The last thing that we want to do is apply additional stress to local populations. On the other hand, so little good information is available that we will strive to get information flowing as soon as we can.

How to Participate

At the present time we plan to begin developing the data base in January 1995. In the interim a "steering committee" has been established to deal with such questions as exactly how data is to be collected and in what form, how it will be packaged, how and where it will be stored, what the data sheets will look like, how access to data will be provided, and what the final products will be. A lot of work remains to be done and we would like to hear form you if you have comments, questions, suggestions, or a desire to assist. A mailing list is being developed and information should start appearing late this summer.

If you are interested in participating in this project please fill out the following form and return it to: **Maryland Herpetological Survey, Natural History Society of Maryland, 2643 North Charles Street, Baltimore, Maryland 21218.**

Name____

Address______________________________________

____

Phone____

Interest: County Coordinator________

(if so, which county ______________________

Suggestions:

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Winston Card
Overview of Research in the Dallas Zoo Reptile Department

Michael Corn, Ph.D.
Herps of Costa Rica

Carl H. Ernst, Ph.D.
Overview of Freshwater and Terrestrial Turtles of the United States

Gary Fogel
Keeping and Breeding Cordylid Lizards in Captivity

Neil Ford, Ph.D.
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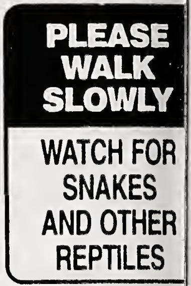
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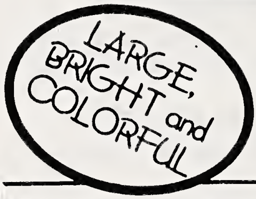

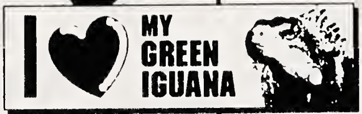

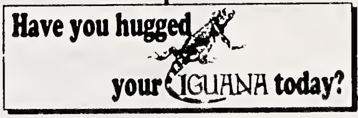

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DISTRIBUTION RECORDS FOR SOME AMPHIBIANS AND REPTILES FROM MEXICO

José L. Camarillo R.

Ten herpetological records are here reported for the states of Hidalgo, Michoacán, Oaxaca, Puebla, Tlaxcala and Veracruz. All specimens on which the records are based were collected and identified by the author. Voucher specimens are deposited in the Collección Herpetológica (ENEPI), Escuela Nacional de Estudios Profesionales Iztacala, UNAM, in Tlalnepantla, México.

Chiropterotriton multidentatus (Taylor). State of Tlaxcala: 10 km N Tlaxco, 21 September 1992 (ENEPI 3888). First state record (Sánchez H., 1980).

Rhinoclemmys r. rubida (Cope). State of Oaxaca; Santiago Lachiguiri, 21 October 1989 (ENEPI 6060). Extends known range 50 km NW Tehuantepec (Ernst, 1978).

Ctenosaura quinquecarinata (Gray). State of Oaxaca: Santiago Lachiguiri, 21 October 1989 (ENEPI 4119-4121). Extends known range 50 km NW of Tehuantepec (Gicca, 1983).

Lepidophyma sylvaticum (Taylor). State of Puebla: Tepango de Rodríguez, 21 April 1993 (ENEPI 5088). First state record (Bezy, 1984).

Scincella gemmingeri forbesorum (Taylor). State of Puebla: Tepango de Rodríguez, 24 April 1991 (ENEPI 4777). First state record (Smith and Smith, 1976).

Conophis v. vittatus Peters. State of Michoacán: Tupitina, 20 km SE Caleta de Campos, 14 May 1991 (ENEPI 4103). Extends known range 74 km SE Coalcomán, the nearest locality of record (Duellman, 1961).

Leptophis m. mexicanus Duméril, Bibron and Duméril. State of Hidalgo: Tlachinol, 18 January 1991 (ENEPI 5992). First state record (Smith and Smith, 1976).

Micrurus bernadi (Cope). State of Veracruz: San Antonio Ixtatetla, 16 km N Huayacocotla, 18 June 1992 (ENEPI 4176). New locality record (Campbell and Lamar, 1989).

Micrurus e. ephippifer (Cope). State of Oaxaca: Santiago Lachiguiri, 21 October 1989 (ENEPI 4118). Extends known range 50 km N of previous records (Rozé, 1989).

Ophryacus undulatus (Jan). State of Veracruz: San Antonio Ixtatetla, 16 km N Huayacocotla, 24 April 1991 (ENEPI 4208). Extends known range 40 km N of El Potrero (Hernández et al., 1992).

Acknowledgments

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THE NOMENCLATURAL STATUS OF MÜLLER'S TWO VARIETAL NAMES OF *DIPSAS CENCHOA* (REPTILIA: SERPENTES)

Hobart M. Smith, Aurelio Ramírez-Bautista and David Chiszar

Dipsas cenchoa rhombeata Müller (1882) and *D. c. reticulata* Müller (1882) are nomina nuda. *Imantodes gemmistratus reticulatus* Kramer (1978) is a junior synonym of *I. g. oliveri* Smith (1942).. Assignment of *D. c. rhombeata* to the synonymy of *I. cenchoa leucomelas* does not make the former name nomenclaturally available. Retention of the subspecies of *I. gemmistratus* and *I. cenchoa* is recommended. The term phenognome is introduced in reference to any phenotypic character.

Müller (1882: 151) listed two specimens, referred to *Dipsas cenchoa* and collected by (or obtained from) Dr. Gustav Bernoulli, in the Natural History Museum of Basel, Switzerland. The following is the only account given for the specimens: "Unsere Exemplare aus Guatémala [sic] gehören 2 Varietäten an, die man in ihren prägnantesten Vertretern als v. rhombeata und v. retuculata unterscheiden könnte. Es sind aber auch Uebergangsstücke dabei. Bei beiden kommen sowohl 17 als 19 Schuppenreihen vor." Loosely translated: Our examples from Guatemala belong to two varieties, which one could distinguish via their most prominent features as variety rhombeata and variety reticulata. At the same time there are, however, also intermediacies [between those features]. Both [specimens] have 17 as well as 19 scalerows.)

With nothing more to go on than that for the original proposal of the new names *D. c. rhombeata* and *D. c. reticulata*, Stuart (1963: 100) commented that "because of their very poor descriptions, [they] cannot be allocated properly at this time." Peters and Orejas-Miranda (1970; 133) agreed, stating that allocation of those names "According to Stuart ... cannot be properly determined because of inadequate descriptions."

So matters stood until 1978, when Kramer (1978: 659) designated a lectotype (BM 1834, a male) from among the original series (BM 1832-7) of *D. c. reticulata*, and a lectotype (BM 1830, a male) from the original series (BM 1830-1) of *D. c. rhombeata*. The collection locality for both groups of specimens was given as Hacienda de Chitalón, Mazatenango, Costa Grande, Guatemala. Kramer also allocated *D. c. rhombeata* to *Imantodes cenchoa leucomelas* (Cope, 1861) as a junior synonym, and *D. c. reticulata* to *Imantodes gemmistratus oliveri* Smith (1942), which was therefore placed as a junior synonym of *I. g. reticulatus* (Müller, 1882). The latter allocation was accepted by Smith and Smith (1993: 570, 702) without comment.

We are aware of no other references to either of those names proposed by Müller. However, we have recently had occasion to review the subspecies of *I. gemmistratus* in Mexico, and in that process discovered that *I. g. reticulatus* is not available as of Müller (1882), but only as of Kramer (1978), hence is a junior, not a senior, synonym of *I. g. oliveri* Smith (1942).

The rationale justifying this conclusion is simple but definitive: Müller's names are nomina nuda, and therefore have no status in nomenclature. There is no description or characterization of either name. They are not even eligible as nomina dubia. The only characterization given, except for the very names themselves, is the existence of both 17 and 19 dorsal scale rows in both intended taxa; nothing was given that would distinguish the two from each other or from any other taxa. Hence those names qualify as nomina nuda and thereby are not available under Art. 12 of the International Code of Zoological Nomenclature. The meanings of the names themselves are insufficient; even the most minimal "indication" must accompany a name. The specimens to which the names were applied likewise (Art. 12c) do not suffice to make the names available.

Under Art. 13, however, Kramer's acceptance of *Dipsas cenchoa reticulata* as a valid name, in the adopted combination of *Imantodes gemmistratus reticulatus*, replacing *I. g. oliveri*, makes the name *reticulatus* nomenclaturally available, but as of Kramer, 1978. Instead of being a senior synonym of *I. g. oliveri*, it is a junior synonym of the latter, hence invalid although nomenclaturally available. BM 1834 hence constitutes the holotype for Kramer's *I. g. reticulatus*, and is not a lectotype, inasmuch as Müller's name does not exist nomenclaturally. Likewise, BM 1832-3, 1835-7, are paratypes, not lectoparatypes.

On the contrary, Kramer's concomitant application of Müller's nomen nudum *Dipsas cenchoa rhombeata* to *Imantodes cenchoa leucomelas* does not confer nomenclatural availability to Müller's name, even as of

Kramer (1978), because the latter author did not regard *rhombeata* as valid, as required by Art 11d for availability.

We are well aware that these concerns for subspecific names may be regarded as an immaterial tempest in a teapot by those who prefer to disregard as untenable all subspecies of both *I. cenchoa* and *I. gemmistratus*, as for example Vanzolini (1986), following cues gleaned from Myers (1982).

In reality Myers (1982: 31) did not explicitly deny the validity of the subspecies of *I. gemmistratus* as conceived by such authorities as Zweifel (1959) and Stuart (1963). He did note (*loc. cit.*) that "there exists no published assessment of variation throughout the range of *gemmistratis*." We infer that his failure to assign the Panamanian populations to subspecies was the logical recourse in view of the limited scope of his study; subspecific allocation would have required a review of northern populations, which he was justifiably unprepared to undertake. He did comment that "specimens from the Isthmus of Panama are fairly similar in color pattern, and all appear to belong the same regional population..." The subspecific allocation of that population remains to be finalized, but until restudied its conventional assignment to the nominotypical subspecies, *I. g. gemmistratus*, is warranted, along with all other Central American populations southward from eastern Guatemala (as Myers noted, *loc. cit.*).

On the contrary, Myers (1982: 23) did explicitly reject recognition of subspecies in *I. cenchoa*: "in the absence of a variational study of the species, I fail to see the point in recognition of subspecies. In any case, the current arrangement of subspecies fails to hold up in Central America."

The latter statement is based upon his observation (p. 19) that specimens "from the Pacific side of extreme western Panama (Chiriqui) have the least bands broken [thus conforming with Smith's 1942 characteristic for a subspecies occurring from Nicaragua to western Panama, *I. c. semifasciatus* (Cope)]. The Chiriqui specimens also have a low total number of saddles and, in this respect, resemble Mexican and northern Central American snakes placed by Smith (*loc. cit.*) under the name *I. c. leucomelas*. Considering the overlapping variation from one end of the country to the other, recognition of subspecies is impractical and serves no useful purpose *in Panama* [our italics]."

The fact remains that geographic correlation of variation does exist in Panama, as made clear by Myers' study. The easiest taxonomic recourse, confronted with that correlation, is to dismiss it as meaningless in a practical way, but a second look with more material could yield a different picture. In any event, the validity of *I. c. leucomelas* in northern Central America and Mexico, separate from the more southern subspecies, whatever they are, is on solid ground and cannot be dismissed in view of its phenotypic consistency. It is refuted solely on the basis of recurrence of its primary phenognome (Gr., *phaino*, visible; *gnoma*, mark) of few blotches in the Chiriqui material. However, the Chiriqui population is different otherwise, in having the rear blotches broken on the sides.

Obviously a thorough study of geographic variation remains to be made of *I. cenchoa* throughout its range, but until such a study is made our admitted knowledge would be significantly diminished by rejection of the steps taken already in recognizing the geographic correlations known to exist and individualized by distinctive subspecific names.

We suspect that much of the resistance in general to the recognition of subspecies is a product of unwillingness to deal with the tedious detail involved in demonstrating their reality. Other reasons exist, of course, but a reluctance to undertake or give credence to the value of the extraordinary effort required to demonstrate the existence of genetically distinct, reliably identifiable populations should not be under estimated or condoned.

Acknowledgment

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OBSERVATIONS OF THE SNAKE GENUS *PLIOCERCUS*, I.

Hobart M. Smith, Van Wallach and David Chiszar

Maintenance of *Pliocercus* separate from *Urotheca*, despite their conspicuous synapomorphies, is supported. It appears likely that *Elapochrus* antedates *Pliocercus*, but the latter name should be retained in any case, with appeal to the International Commission on Zoological Nomenclature if necessary. Savage and Crother's delimitation of *P. euryzonus* is a major breakthrough in the taxonomy of the genus, although recognition of *P. e. dimidiatus* is tenable.

The review of the taxa of *Urotheca* formerly referred to *Pliocercus* (Savage and Crother, 1989, hereinafter S-C) embodied three major conclusions: (1) that *Pliocercus* Cope (1860) is a synonym of *Urotheca* Bibron (1843), to which all taxa of the former genus should be referred; (2) that material of the former genus from Nicaragua into South America all belongs to *U. euryzona* (Cope, 1862), without subspecies; and (3) that material of the former genus from Honduras northward into Mexico all belongs to *U. elapoides* (Cope, 1860), also without subspecies. We here comment on the first two of those three conclusions, as well as on a nomenclatural problem concerned with the nominal genus *Pliocercus*. The third conclusion is to be dealt with separately.

The Biological Status of *Pliocercus*

S-C convincingly documented the close relationship of *Urotheca sensu stricto* (i.e., including *U. decipiens* (Günther), *U. dumerili* (Bibron), *U. fulviceps* (Cope), *U. guentheri* (Dunn), *U. laterostriga* (Berthold), *U. multilineata* (Peters) and *U. pachura* (Cope), and now *U. myersi* Savage and Lahanas, 1989) and *Pliocercus* auct.

We can confirm the presence of the "distal naked pocket" (Myers, 1974: 32) peculiar to the hemipenis of both groups of species (S-C: 338-340, as well as paired basal hooks and other features described by the latter authors, in eight specimens from Mexico and Guatemala (UCM

23159, 25889, 39959, 40683, UTA 21700, 21716, 25830, 28465, each representing a different geographic area).

S-C recorded no overlap between the two groups of species in number of maxillary teeth, the "Pliocercus" group having 18-19+2, *Urotheca* s. s. 11-17+2. Thirteen of the former group that we examined revealed a wider range, 15-18+2, thus demonstrating an overlap of three in a total range of nine (UCM 22357, 30888, 16+2; UCM 23159, 40698, 17+2; UCM 40685, 40692, 49350, 18+2; UTA 22185, 15+2; UTA 14143, 21699, 28470, 16+2; UTA 23205, 17+2 but no diastema; UTA 12393, 18+2; all major geographic areas represented).

The two groups of species are basically similar in scalation, but their synapomorphy of a peculiar hemipenial structure (the "distal naked pocket") along with a peculiar caudal structure (tail long, thickened, readily urotomic intervertebrally) was crucial to the conclusion by S-C that the two groups of species are of common ancestry and congeneric, falling under the name *Urotheca*. S-C considered three alternatives in recognition of the close relationship of "*Pliocercus*" and *Urotheca* s. s., complicated by the fact that the latter group conventionally has been lumped with *Rhadinaea* Cope (1863) in spite of priority of its name over the latter. The promised petition (Myers, 1974: 16) to conserve *Rhadinaea* never materialized, hence under the Code *Urotheca* should have replaced *Rhadinaea* long ago, although no sane taxonomist would have made such a change. However, removal of *Urotheca* from *Rhadinaea* resolves the problem of priority of the former over the latter.

Caudal apomorphy actually is not unique to the *Urotheca/Pliocercus* complex, as it occurs also in *Enulius* (S-C: 334), *Scaphiodontophis* and *Natriciteres* (Mendelson, 1993: 170), independently derived in each case (except for *Urotheca* s. s. and *Pliocercus*). Mendelson (1991: 81) recorded "tail breakage" (not differentiated from "tail autotomy") also in *Drymobius, Coniophanes, Rhadinaea, Sibynophis* and *Thamnophis*.

Although we heartily concur with revival of *Urotheca* for the lined and unicolor species concerned, we regard the inclusion in it of *Pliocercus* as unwarranted. The remarkable synapomorphy of the two groups of species, strongly indicative of common ancestry (with the ringed group presumable evolved from the lined/unicolor group), does not necessarily preclude dichoapomorphy in other respects sufficient to warrant generic separation.

Dichoapomorphy in this case involves (1) the remarkably extensive mimicry in the patterns of *Pliocercus* ("nearly 100%," fide Roze, 1983) of those in sympatric species and subspecies of the strongly venomous coral snakes (*Micrurus*); such mimicry is completely absent in *Urotheca* s. s. The selection pressures involved in such mimicry should not be underestimated. Moreover (2), *Pliocercus* has a surprisingly potent venom itself (Seib, 1980). whereas the venom in *Rhadinaea* and *Urotheca* s. s. is weak (Myers, 1974). Thus both deceptive (Batesian) and reinforcement (Müllerian) mimicry occur in the *Pliocercus/Micrurus* association. And lastly (3), *Urotheca* (as exemplified by *U. guentheri*) has a subterminal tracheal entry into the right lung, whereas both *P. elapoides* and *P. euryzonus* exhibit a terminal entry. All three features are derived in *Pliocercus*. We regard these unique dichoapomorphies as ample justification for separation of *Pliocercus* from *Urotheca*. Smith and Smith (1993: 473-4) have previously so argued, and Myers and Cadle (1994: 3) likewise so concluded.

The Nomenclatural Status of *Pliocercus*

Although *Pliocercus* Cope (1860) has been accepted as valid in at least 153 different works from 1861 to the present time (Smith and Smith, 1976, 1993), whereas its synonym *Elapochrus* Peters (1860) has been taken as valid in only three works (Müller, 1865: 609; Wallace, 1876: 375; Günther, 1893: 106) since its proposal, priority of Cope's name has long been open to question. Williams and Wallach (1989: 52) noted that both Müller and Günther gave June 7, 1860, for the date of publication of Peters' name, June 26 for Cope's. Those dates, however, are merely those on which meetings were held during which the papers were presented or authorized for publication, not the actual dates of mailing (= "publication" under the Code). Williams and Wallach (loc. cit.) showed that publication of the signature containing Cope's article must have been much later than June 26, and called for suppression of *Elapochrus* in order to assure validity of *Pliocercus*.

Salvin (1861) accepted Cope's name on grounds that it preceded Peters' (1860: 293) *Elapochrus deppei* by two days. It is not now apparent on what basis Salvin determined dates of publication, although it likely that he judged from dates of receipt in London. The latter cannot now be verified because no records exist for that period (McCarthy, pers. comm.).

A persuasive argument that *Pliocercus* appeared before *Elapochrus* is the acceptance by Peters himself (1870: 876) of that conclusion. However, he may well have done so on mere consensual grounds, or upon some interpretation of date of publication other than date of mailing.

Cope's article was published prior to Sept. 30, 1860, because receipt of signatures 12-18 (appearing as one) containing it was acknowledged during the quarter ending Sept. 30, 1860, by the Boston Society of Natural History (Proc., vol. 7, 1860, p. 352). How much earlier it was mailed is uncertain, but it likely was well after June 30 (the beginning of the mentioned quarter), because signature 6 was acknowledged by the Smithsonian Institution June 15, 1860 (Nolan, 1913). No dates of receipt are known for signatures 7-8 (in one), but since the preceding three were acknowledged at ca. monthly intervals (Mar. 21, April 13, June 15), it is probable that signatures 12-18 were mailed in September.

After gathering all information available at the time on the publication dates of both Cope's and Peters' names, the International Commission on Zoological Nomenclature was petitioned in 1993 for suppression of *Elapochrus*. The Commission replied, however, through its secretarial office, that suppression of *Elapochrus* is not necessary inasmuch as evidence indicates that the article in which it appeared was not published in 1860 as has generally been assumed, but in 1861. The file was therefore stated to be closed on this case, no Commission action being necessary.

When the petition was submitted to the Commission, no authoritative source of information had been found on dates of mailing of the parts as published on volume 25, for 1860, of the Monatsberichte der königlich preussischen Akademie der Wissenschaften zu Berlin, in which Peters' paper appeared. Internal evidence strongly suggested that publication took place monthly, because the articles and minutes of each month begin on the right-hand page no matter where the preceding ended. In such case, the entire proceedings for June, including the last session held June 28, could well have been printed and mailed in July, thus probably antedating the mailing date for Cope's article.

The commission's letter, on the contrary, stated that "the earliest date for the appearance of Peters' name *Elapochrus* seems to be 1861... It is possible that the journal was published in parts before these were eventually included in a complete volume but we can find no support for this. We feel that stronger evidence than the pagination of the volume for 1860 would be needed to say that Peters' paper had appeared that year. Even if it were accepted, it would be impossible to say how soon after the June meeting of the Akademie the paper had been published. The *Proceedings of the Academy of Natural Science of Philadelphia* (13: 541; 1862) listed among the donations to the Academy library during 1861 'Berlin. Monatsberichte der Konig. Preuss. Akad. der Wissenschaften zu Berlin, Jahre 1860. From the Royal Prussian Academy of Science."

The "stronger evidence" desired by the Commission has subsequently come from Dr. Aaron M. Bauer, who is researching Peters' publications with Drs. R. Günther and M. Kipfel. They have found original, dated wrappers for almost every issue of the German journal in the pertinent era, showing that the Monatsberichte was mailed usually within one month of a meeting, and always within three months (the longest gap is of one October issue mailed in January, although most December issues were mailed that month). The June issue certainly appeared in 1860, as indicated also by Salvin's (1861) statement that it appeared so close to the arrival of Cope's article, and by Troschel's (1862: 129) inclusion of both works in his review of herpetological publications appearing in 1860.

Accordingly, although no incontrovertible evidence at present threatens the priority of *Pliocercus* over *Elapochrus*, it now appears possible, even likely, that Peters' description, from the June meeting, was mailed prior to Cope's, in July and almost certainly no later than September, when Cope's description, also from his June meeting, probably was mailed. Conclusive evidence of precedence of Peter's description may well come to light at some time in the future, necessitating reopening of the case, but until then the status quo should be maintained. Under no circumstance at this late stage, however, should *Elapochrus deppei* be permitted to replace *Pliocercus elapoides*, as the Commission has in effect already agreed unofficially.

The Taxonomic Composition of *P. euryzonus*

The conclusion of S-C that *P. euryzonus* is allospecific relative to *P. elapoides* and the only representative of the genus from Nicaragua into South America is a welcome breakthrough with which we heartily concur. It presumably is plesiomorphic relative to the rest of the genus, not having evolved the tricolor pattern characteristic of the more northern representatives of the genus.

No subspecies of *P. euryzonus* were recognized by S-C, because of the stated existence of clinal variation in the species, and because of the antisubspecific philosophy expounded in Savage and Heyer (1967: 123-124) and to which S-C still subscribe (a philosophical evolution by Savage from earlier views, as exemplified by Savage 1949, 1952a, 1952b, 1954 and by Savage and Cliff 1953).

Despite attacks beginning in the early 1950's and continuing to the present on the subspecies concept, that category continues to find abundant use, both retrospectively and innovatively (e.g. Taylor et al. 1994; Tanner and Lowe, 1989; Conant, 1984).

We subscribe to a positive vision of the place of subspecies in zoological taxonomy, involving no conflict with the Phylogenetic Species Concept, partially on grounds expressed by Smith and White (1956), and partially because of the importance of subspecies in considerations of conservation and protection. Properly understood, they do constitute genetically unique populations, and as such, even if not effectively closed, merit as much concern and recognition as other genetically unique populations. Abandonment of such a long-accepted and vital category as subspecies is neither warranted nor necessary, even in a strictly phylogenetic classification, to which they can be regarded as an adjunct, without change of name or treatment.

For those who regard subspecies recognition as justified where warranted, it is evident that two exist in *P. euryzonus*: the nominotypical one, in South America and eastern Panama, having very narrow (1/2 scale length) white rings on an otherwise black body and tail, a light bar across parietals about equally narrow (often barely indicated) or broken; and *P. e. dimidiatus* Cope (1865), having broader (about one scale length or slightly more) red, yellow or white (or combinations thereof) rings on head, body and tail. Intergradation occurs in central Panama, on which basis geographic variation in the diagnostic features of the two subspecies was interpreted by S-C as clinal, hence not acceptable for taxonomic recognition. However, the cline is certainly not even close to rectilinear, as would admittedly justify their conclusion, but is strongly stepped. Consistency of the diagnostic character-states over large geographic areas, separated by a narrow area of intermediacy, justifies subspecific recognition under our interpretation of the subspecies concept and of the nature of the geographic variation occurring in *P. euryzonus*.

Acknowledgments

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AN APPARENT NORTHERNMOST LOCALITY OF RECORD FOR *SCELOPORUS TEAPENSIS* (REPTILIA: SAURIA), AND ITS SYMPATRY WITH *S. V. VARIABILIS*

Hobart M. Smith, John Weigel and David Chiszar

A single adult *Sceloporus teapensis* among 34 *S. v. variabilis*, all taken in 1978 near Xalapa, Veracruz, Mexico, is the northernmost recorded for the species and documents anew the sympatry of the species with *S. v. variabilis*, and concomitantly the allospecificity of the two taxa, rather than allosubspecific conspecificity.

In 1978, one of us (JW), then an undergraduate EPO Biology major at the University of Colorado, spent a semester enrolled in the University of Xalapa, Veracruz, Mexico, during which time he collected a few reptiles and amphibians in the near vicinity of the city. Not until the present time was the bulk of the collection (part has been lost) studied and cataloged, although all of its representatives of the *Sceloporus variabilis* complex were reported (as *S. v. variabilis*) by Guillette et al. (1983) in a study of unilateral pigmentation of the pleuroperitoneal covering of the testes.

The collection as it now stands contains some 15 species, all represented by 1-3 specimens except for a series of the *S. variabilis* complex, of which there are 35. That series (UCM 57100-34) is of great interest in representing both *S. v. variabilis* Wiegmann (34) and *S. teapensis* Günther (1), the latter of which has alternatively been regarded as a full species or as a subspecies of *S. variabilis* (see Smith et al., 1993, for a historical review.

The single *S. teapensis* (UCM 57100) has 38 dorsals, very large preinguinals, nine sacral rows of dorsals and 11 nuchal rows, and a single canthal. In the specimens of *S. v. variabilis*, the dorsals (31) vary from 52 to 64 (x=56.5); the preinguinals are consistently relatively small; the sacral rows (34) 10-12 (x=10.9) except for one with 9; the nuchal rows (33) 12-16 (x=14.2); and the canthals are 2-2 except for two with 1-1.

There is a major gap in dorsal scale count, of 12; the difference in size of the preinguinal scales is also prominent; and there is no overlap in number of nuchal rows of dorsals. A slight overlap exists in number of sacral rows of dorsals and in number of canthals, but there is no question that UCM 57100 represents *S. teapensis*, which is presumably not common as compared with *S. v. variabilis* in the Xalapa region.

The northernmost previous record for *S. teapensis* (Smith et al., 1993: 113) is 1 km S Mocambo, Veracruz (a suburb of Ciudad Veracruz), where it was taken along with *S. v. variabilis* (op. cit.: 115). The present record extends the range of the former species some 35 airline km northward.

The range overlap of the two species thus appears to cover about 235 km in a diagonal direction from the vicinity of Xalapa southeastward to the approximate latitude of 18° N (compare map Fig. 6, Smith et al., 1993: 123). Such extensive sympatry strongly suggests that the taxa represent separate species.

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ANNOUNCING THE MARYLAND HERPETOLOGICAL SURVEY

It's been almost twenty years since the Natural History Society of Maryland, Inc. published the last edition of the Distributional Survey (Amphia/Reptilia): Maryland and the District of Columbia by Herbert S. Harris, Jr. In that time three species have been added to the state's fauna, concepts of the local distribution of many species have changed, and concern has been expressed over the apparent reduction in numbers of various species. The NHSM is initiating a five year survey of Maryland's herpetofauna leading to preparation of a comprehensive publication (or publications) dealing with local herpetology. This survey will have several facets, as described below.

Distributional Data

Species distributions will be depicted with computer generated maps based on the U. S Geological Survey quad system. This will provide a reasonable degree of accuracy, easy update, and reliable documentation. Although the database will be maintained at a central location, county coordinators will be assigned to receive and review data for their area. When this project gets rolling, we anticipate that draft maps will be circulated on a regular basis to identify gaps where special attention should be directed. These maps can be coded to show historic vrs. current records.

As has been traditional with herpetological survey efforts, we welcome data associated with well preserved specimens deposited in a permanent collection. However, consistent with today's emphasis on observation as opposed to collection, we also consider sight records from reliable observers to be acceptable. Unusual occurrences or records for species that may be confused (i.e., "coastal plain milk snakes" and scarlet snakes, or new records for rainbow snakes) should be document photographically, and we encourage maximum use of cameras. The NHSM is establishing an archive for permanent storage of such slides and photographs.

Natural History

The North American literature contains a wealth of information about the natural history of the amphibians and reptiles that occur in Maryland. However, most of that information came from other areas and relatively little is specific to this state. For instance, can anyone precisely define the period during which gray treefrogs or narrowmouth toads call in Maryland? Conant and Collins, because they consider the entire range, give a period that s much too broad. Management of our local amphibian and reptile species requires that we know much more about their life histories than we do. Consequently, we are taking this opportunity to gather every bit of biological information that we can get on every resident species. Participants are encouraged to record and report all biological observations, even those that seem ordinary. A standardized record form will be provided for this purpose. The following list gives examples of the kinds of questions that we hope to answer.

> Have you observed changes in local distribution? Do you see species now that you did not see the past, or vise versa?
>
> When exactly do various species of frogs start and stop calling?
>
> What do our herps eat, and what eats them? What kind of aggressive encounters occur?
>
> When do they mate? When and where do they lay eggs, and how many? Do you note evidence of nest predation, and do you know what did it?
>
> What kind of parasites occur on/in wild caught herps?
>
> Where do our amphibians and reptiles hibernate (have you ever dug out a snake or frog in winter), and when do the enter and leave hibernating areas?

Long-term Population Monitoring

We also propose to coordinate a series of long-term studies at selected localities (one in each county would be ideal) to monitor numbers of reptiles and amphibians at specific locations. These surveys will be modeled after the one now being conducted at the Jug Bay Wetlands Sanctuary in Anne Arundel Count, and should detect and

document any changes that may be occurring in local populations. The role of the NHSM in this effort will be to help establish programs to provide even coverage, to ensure that comparable data is being collected in a standardized fashion, and to collect and evaluate data to formulate a state-wide picture. We can also serve as a clearinghouse for the dissemination of the data obtained to participants and other interested persons.

Another aspect of this survey will be an effort to gather personal observations of changes in abundance and distribution. We constantly hear naturalists lament that spotted salamanders no longer spawn in the pond in their woods or that a favorite copperhead den has been destroyed. Such information has been given little credibility because it is anecdotal, and no effort has been made to verify and quantify it so that it can be considered when management of amphibian or reptile populations is considered. We feel that such information is useful and will make every effort to compile it.

Accessibility of Data

Although our ultimate goal is publication of the data gathered, this will be an interactive association with relatively free access to information. We hope to find funding to computerize early-on. If so, we can generate regular hardcopy updates or open the files through the phone lines. However, security will be placed on sensitive information. The last thing that we want to do is apply additional stress to local populations. On the other hand, so little good information is available that we will strive to get information flowing as soon as we can.

How to Participate

At the present time we plan to begin developing the data base in January 1995. In the interim a "steering committee" has been established to deal with such questions as exactly how data is to be collected and in what form, how it will be packaged, how and where it will be stored, what the data sheets will look like, how access to data will be provided, and what the final products will be. A lot of work remains to be done and we would like to hear form you if you have comments, questions, suggestions, or a desire to assist. A mailing list is being developed and information should start appearing late this summer.

If you are interested in participating in this project please fill out the following form and return it to: **Maryland Herpetological Survey, Natural History Society of Maryland, 2643 North Charles Street, Baltimore, Maryland 21218.**

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